Electrical World

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A Peaceful Revolution

A HUNDRED years ago began an industrial revolution—machinery was invented, and the steam engine, up to that time used only for pumping water, was developed as a power unit. Factories grew, business developed. Everywhere brains, labor and materials since that time have become gradually specialized. Ten years ago another underrunning current came to the surface. Business men began to think of business costs; they began to ask why it paid to specialize and when it paid to specialize; they began to look for data and reasons. For the last few years a greater and more potent force has been developed, for the most part unseen. To-day business men are ready to be shown *why* business has been broadened. Some men have gone beyond the specializing stage and are classifying groups of specialists and trying to find a philosophy of business. In the end perhaps they are seeking a science of business. This change in general business is being reflected in the electrical industry. With this difference, that the analytical method of taking a business problem apart is, after all, an engineering method, and in an industry in which the influence of engineering is so widely spread, the development of the newer way should be much more rapid than in the rule-of-thumb business. There is one danger. We must not perfect methods and forget that they were designed to get business. A beautiful plan is a fine thing; but its perfection is wasted if it will not produce results.

Capitalizing Electric Service

"BY their rules against the use of electric appliances in guest-rooms shall ye know them" might be written of the few old-style hotelkeepers whom a tolerant Providence still permits cunningly to contrive 3-amp. fuses on room circuits so that the guilty wayfarer's iron, curling tongs or toaster stove will fatedly pull down upon its owner and her suite the awful pall of retributory darkness—escape from which lies only through frank appeal and confession of sin at the office. But, turning from such placard warnings against electric irons, it is refreshing to find that there are already many progressive hotel managers who actually encourage the use of electrical comforts and conveniences by their patrons, and who recognize that the few kilowatt-hours consumed by guests' appliances are of trifing cost compared with the resulting enhancement of the attractions of the house. A great new caravansary opened at Atlantic City has some 2800 plug receptacles installed unobtrusively in the baseboards of its guest-rooms. The tavernkeeper who is not yet "in line" needs to receive a word of advice about what his patrons expect and demand. Every electrical man who meets such a hotel man of the old school, either as customer or as patron, can help—by inquiry and suggestion—to speed the grateful day of electric service for guests.

Planning Ahead for Business

IN the copybooks of the bygone generation there used to be a sentence reading, "Procrastination is the thief of time." To the schoolboy it always contained an unfair implication of slothfulness, but nevertheless it is true first, last and all the time. The particular person to whom we here apply it is the man who is responsible for the business getting in the ordinary central station. This gentleman is not usually a "slacker" by temperament or education, and yet it is extraordinarily easy for the days and weeks to slip along at the high pressure that characterizes central-station work without those things being done which are necessary to procure customers. How often have we heard it said that it is about time to start an aggressive campaign for appliances, and that it would be a good idea to bring it to the attention of the salesmen very soon! It is duly passed over to these gentlemen with twenty more suggestions as to ways in which they can make themselves useful. No great attention is paid to the probable deliveries of the stuff wanted, and the result is that the campaign which should start at once is postponed. The same thing may and often does happen in other branches of business campaigning. Between the salesman, the customer, the engineering department, and the manufacturer behind in his orders, actual receipts are in this way long delayed. Very few central-station managers can search their hearts without a twinge of conscience in the matter of unnecessary delays. Even persistent and well-trained salesmen are not always so keen "on the job" as they should be.

Psychology of a Name

ALTHOUGH every successful public-service company must maintain a department in order to hear and adjust the complaints of its patrons, it does not follow necessarily that the department shall be known as a "complaint department." There are nicer names for designating this subdivision of the company. It might be better taste to call it the "adjustment division" or the "efficiency bureau" and take advantage of the thought that lies behind the name. To make this plain,

consider the mental attitude of the customer who enters a company's office with a grievance. He espies the sign "Complaint Department" or, more saucy still, "Complaints," and he says to himself, "Ah, ha! There is the place where I can register one fine large kick." Whereupon the diplomat behind the "complaint" sign will be subjected to a considerable quantity of abuse. But if the same complaining customer had been courteously directed to an "adjustment division," his thought of complaining would have properly become secondary to the real issue, namely, that of securing an adjustment of his difficulties. Then conversation between the company's representative and the customer could have been carried on in a spirit of friendliness and the adjuster could have spent his time profitably learning the real cause of the trouble instead of being obliged to devote his entire mind and voice to the task of convincing his caller that the company believes in fair dealing. To maintain a publicly acknowledged "complaint department" is also to the man with a grievance conspicuous evidence that complaints against the service must be numerous and well deserved, which intensifies his ire.

Hunting Trouble on Overhead Lines

The use of an interrupted current and an exploring coil is a fairly well-known method of locating faults in cables. Its first use dates back to fourteen or more years ago, when Thomas W. Varley reduced the principles of the methods to practical application for hunting faults in New York's underground alternating-current distribution system. The scheme has found its most extended application in the testing of power cables. However, it has been re-invented in several forms and introduced into the telephone field. A recent adaptation of the method by a New England central station and the ways in which it is employed in locating faults on overhead circuits are explained in the columns of this issue. By this method linemen of ordinary ability can locate faults with remarkable speed and accuracy.

A motor-driven test-circuit interrupter, either stationary or portable, an automobile, and exploring coils of a character suited to the nature of overhead-circuit faults, make up the equipment. The troubleman is able to run down such faults on both live and dead lines, and determine whether they are due to an open circuit, a short-circuit, a cross or a leakage. The waves introduced by the interrupter, having a maximum frequency of about 600 cycles when impressed on a sixty-cycle line, can be picked up in a properly designed telephone receiver on a circuit carrying 200 amp. The method facilitates the tagging of cables and the identification of phase wires even to an individual lamp socket. The continuity of the street-lighting circuit is rapidly checked on the Boston system by following the line in an automobile with a small "fishpole" antenna. The characteristic electrostatic induction of the line is interpreted by the troubleman, through the telephone receiver, and shows to a pole the location of the break.

Other schemes may be, and probably are, in private use that are as effective as the ones described when used by experienced trouble finders. We do not know, however, of any method so developed as to lend itself to such general application on alternating-current circuits up to 13,800 volts and direct-current circuits of any voltage for the location of faults of any character when handled by the average troubleman. These methods seem worthy of special mention because they help in the carrying out of the central-station policy of uninterrupted continuous service.

Further Developments of Railroad Wireless

Wireless-telegraph receivers of modern design are as well suited to the reproduction of vocal sounds as of Morse dots and dashes. To impress articulate speech variations upon radiant electromagnetic waves, however, requires apparatus somewhat different from that which suffices for telegraphy. In each case there must be a generator of radio-frequency oscillations and a controller of these oscillations. In telegraphy almost any sort of condenser discharge will serve as the generator, and a simple switch or Morse key as the signaling element. For telephony, however, the train of discharges must be refined to a high degree, so that irregular noises will not interfere with articulation, and the controller must be of the quantitative type well represented by the carbon microphone.

In wire telephony the current-handling limitations of the carbon microphone have not yet put a stop to the extension of lines over greater and greater distances. In radiotelephony, however, the radiated energy spreads over the surface of the earth in all directions. A very small part of that sent out reaches any given receiver. The initial disturbance to produce an audible response must therefore be correspondingly greater than in wire signaling. For radiotelephony, where the carbon microphone is the only widely used modulator so far proposed, the commercial current limit of about 0.3 amp. must be far exceeded if even moderate distances are to be covered. Microphones to handle heavy currents have time and time again been shown to be erratic, and in this lies the reason for irregularity of operation of very nearly all radiotelephones which have been brought out up to the present.

The recent work of the Delaware, Lackawanna & Western Railroad, as described by John L. Hogan, Jr., in this issue, is of interest to all concerned with electrical communication. Wireless telegraphy on railroads has proved its worth as a practically indestructible auxiliary to wire lines and has demonstrated its practicability for signaling to and from moving trains. At fixed points the radiotelegraph has been found to fit into station routine without requiring marked readjustment. The Morse wire operators are entirely capable of operating and maintaining the radio plant. On the train, however, a Morse operator is an extra expense; it is therefore desired to provide signaling apparatus which can be handled by any member of the

train crew. The radiotelephone will be such an apparatus so soon as the difficulty of modulating clearly is overcome, and the Lackawanna experiments will probably hasten this most desirable end. The wireless telephone will then find awaiting it a field of operation which should be extensive and valuable.

Planning for the Factory Substation

A far-sighted commercial policy in central-station motor-service solicitation is evidenced where a company's representative confers with the factory architect before the construction of the mill buildings and obtains some consideration relative to the location of a future transformer station within the premises. Even where a concern is disposed to install its own generating plant, it is good "missionary work" to study with the owners or the architects the possible future locations of transformer equipment. The days are passing when this apparatus is going to be installed in a haphazard fashion, and as much real engineering can be seen in this branch of power service now as in the application of motors. Compared with the limitations in space of an engine or turbine plant, the factory substation has few disadvantages. It can be installed in many otherwise unused locations, but none the less will cost the owner and the central station more or less according to the amount of prevision shown in considering it. Material and copper saved by locations near distribution centers are certainly worth taking a little extra trouble early in the game to study, and even if the installation of purchased power is deferred, the selection of the right place for the equipment in advance means better and quicker facilities when the central station finally comes into its own.

Helping the Switchboard Operator

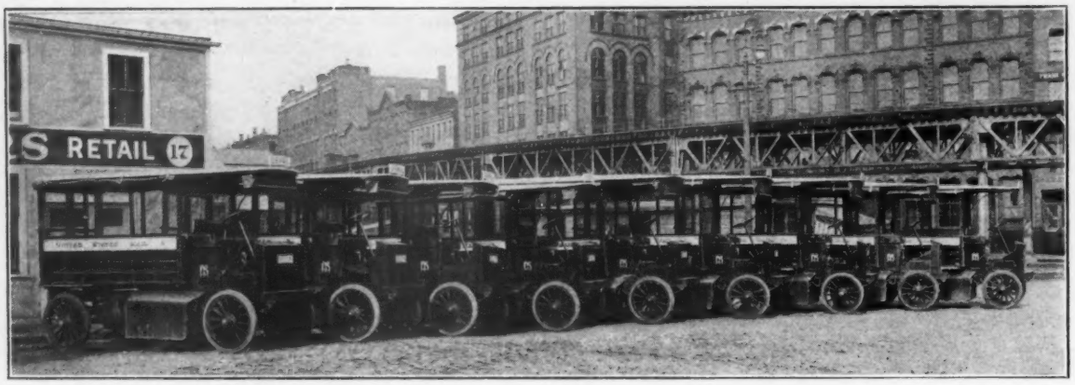
An examination of a considerable number of electric generating plants will disclose in altogether too many cases a scattered formation of switchboard panels that tends to hinder convenient and efficient operation. Occasionally, all the station auxiliary electric service will be controlled from a board mounted against the wall and at the rear of the main panels for the generating units, exciters and outgoing feeders. In another case the board controlling the incoming lines will be situated at right angles to the main operating board and extend so far behind the latter that a part of the instruments are hidden from the operator when he stands in the middle of the main panel group. Other instances might be cited where certain classes of service are segregated at panels perhaps fifty feet away from the main board. Sometimes even sections of the switchboard are found on different levels.

Circumstances may now and then dictate the abandonment of symmetrical arrangements in switchboard installations, but as a general proposition it is good practice to lay out the switchboard area so that the entire group of panels can be dominated from a single point, with as few corners as possible to turn in order to reach panels in emergencies. Benchboard control, of course, largely accomplishes this, but many plants are not equipped with remotely operated switches and are not likely to be. Even at the cost of extra duct construction in the floors or beneath them, it is good engineering to lay out switchboard equipment, whether in remodeled or in new plants, so that it can all be seen within at least a few feet of the same center of manipulation. Quick action is the essential consideration at times when the dropping out of step of important equipment means penalties for interrupted service. A little more money expended for cables in order to secure this quick action goes a long way toward insuring the quality of service which is the chief commercial asset of the installation.

High-Frequency Tests of Insulators

In any insulator electrically stressed in the steady state the electrical stresses are understood to be determined entirely by the local potential gradients. At low frequencies the stresses are probably assumed in each cycle almost as they would be in the steady state. That is, sufficient time is allowed in each cycle to develop the system of potentials in and around the insulator, almost as though the potentials were impressed steadily. If we now raise the frequency, at least two new things happen: first, the alternating charging current in the insulator, considered as a condenser, increases with the frequency, and this current passes through the substance of the dielectric. There may be a critical density of displacement current which a material will withstand without injury and which would be capable of being reached at high frequency long before it could be reached at low frequency. This maximum current density would be expected near to the electrodes; that is, near either to the line-wire terminal or to the pin, or to both. Secondly, time must be required for the dielectric stress to be projected through the substance of the pin, and at high frequencies it may be that insufficient time is allowed for the stresses to deploy. Such a condition might readily develop unduly intense stresses at and near the electrodes. This time of stress propagation might be occupied in the passage of charging current through insulation-resistance paths, or it might be of a purely dielectric character.

A series of high-frequency tests were lately made upon insulators to determine their ability to withstand the over-voltages caused by lightning. The insulators were subjected to this new "impact" test because an insulator may rupture at its pin under a voltage at a high frequency which would not be destructive at a low frequency, and which, moreover, would flash over the surface, instead of puncturing at the pin. Since, therefore, the electrical stresses which a line insulator has to withstand in practice may sometimes have a high frequency, the inference follows that the ordinary low-frequency tests of insulators are insufficient to determine their actual strength. The results of such tests manifestly have great practical significance in the design and manufacture of line insulation.



ELECTRIC TRUCKS IN GOVERNMENT MAIL SERVICE AT BOSTON

Nine one-ton electric trucks are now employed by the Boston Post Office for hauling the mails. The vehicles are operated by a private contractor, who from experience gained in similar work in several other large cities finds "the electric way" the most economical and reliable. The trucks are supplied with energy on the battery-exchange system and travel on the average about 3500 miles per month.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Merchants to Join in Celebrating "Prosperity Week" at Louisville

Members of the Jovian League of Louisville, Ky., have secured the co-operation of local mercantile interests in the celebration of Electrical Prosperity Week, and a committee to arrange for the event has been formed with representatives of all Louisville business organizations. It was decided at a general meeting, however, to call the general celebration simply "Prosperity Week," the argument being advanced that support would probably be forthcoming in larger measure if this were done. The electrical feature will not be lost sight of in any way, however, as the Jovians will promote Electrical Prosperity Week as one feature of the celebration of the more inclusive event. Those in other lines will develop their own special interests in the same manner, and it is hoped thereby to get the greatest possible interest from all quarters. An electrical parade is planned as one of the main features of the week, with prizes to be offered for the best decorated floats. The decorations for this night pageant will, of course, be chiefly electrical. It is also expected to have several hundred electric vehicles in line.

Electrical Prosperity Week Campaign Launched in New England

More than 200 electrical contractors, supply dealers and jobbers were guests of the Edison Electric Illuminating Company of Boston, Mass., at a dinner in the restaurant of the company's general service buildings on the evening of Sept. 8, the meeting having been called to launch a New England Electrical Prosperity Week campaign in connection with the nation-wide celebration, Nov. 29 to Dec. 4 inclusive. L. D. Gibbs, superintendent of the Edison company's advertising department, presided, and emphasized the benefits of co-operation in connection with the forthcoming campaign. Plans are afoot to enlist the enthusiasm of central-station men all over New England in the campaign.

Special publicity will be employed, as in other parts of the country, to bring home the significance of Electrical Prosperity Week to the population of New England. Fifteen large electric signs on the trunk-line railroad, electric-car and automobile highway routes into Boston will be devoted to the cause, and advertising cards will be displayed on every street car in the forty-two cities and towns in the Edison territory for two months, at a cost of $2,800. The company will also spend $1,200 in bill posting. W. H. Atkins, general superintendent of the company, is chairman of a special committee on illumination, and at the dinner a committee of seven contractors, jobbers and dealers was appointed to concentrate co-operative efforts. This committee consists of Messrs. Holder, Billings, Potter, Sanderson, St. George, Jacobs and Brown. The feature of the evening was an illustrated talk upon the aims and plans for Electrical Prosperity Week by H. W. Alexander of the Society for Electrical Development, Inc.

Municipal Ownership Plan Discarded at Pepperell, Mass.

The authorities of the town of Pepperell, Mass., have accepted a proposition for the supply of electric service by the Shirley (Mass.) Electric Company, the plan involving the sale of the municipal electric distributing equipment used in street lighting and the construction of a substation by the new owners.

At present the town owns the distribution circuits, poles, etc., required for the operation of 195 40-watt tungsten lamps in highway service, a moonlight schedule of 2411 hours per year being in force. Energy for the operation of these lamps is purchased from the Nashua River Paper Company at a rate of 11 cents per kilowatt-hour on the primary side of the constant-current transformer. The yearly cost of operation per lamp is $17.97. The rates for commercial lighting and power are 15.5 cents per kilowatt-hour, 12 cents per kilowatt-hour for churches, and lamps at the customer's expense. The street-lighting investment of the town is $7,755.

Under the new schedule the Shirley company will pur-

chase the street-lighting circuits and poles and will maintain the service at a rate of 10 cents per kilowatt-hour at the primary voltage of the constant-current transformer. The operating cost per lamp will be $11.75 per year. Energy for commercial lighting will be furnished at 12 cents per kilowatt-hour, with a minimum meter charge of $9 per year. Power rates will range from 12 cents for the first 100 kilowatt-hours' use per month to 2 cents per kilowatt-hour for all energy in excess of 1500 kilowatt-hours per month, with the foregoing minimum meter charge.

Extensions will be made on the streets for commercial lighting and power service when the cost does not exceed $50 per extension. All extensions in excess will be made upon a guarantee of reasonable return upon the investment. The company will extend its service wires up to 100 ft. on private property free of charge.

Paper Maker Becomes Central-Station Customer

In negotiating these arrangements the Nashua River Paper Company advised the town officials that instead of supplying energy to the municipality it now desired to purchase electricity from the central-station system. Rainsford Deware, president of the Pepperell Card & Paper Company, also expressed himself as desirous of purchasing electrical energy instead of enlarging his own plant to meet early requirements in the power field. A proposition was submitted by the Connecticut River Transmission Company of Worcester, Mass., for the supply of energy at the town line at 2.5 cents per kilowatt-hour on a five-year or ten-year basis, the town to distribute electricity except to consumers of 25 hp. and above.

The town authorities also considered investigating the establishment of a municipal lighting plant, but preferred to turn the system over to the central-station company. The acceptance of the Shirley company's plan will save the town $2,613 yearly in the cost of street and commercial lighting, or about $1 per capita, and will confer upon the community the industrial advantages of an adequate and low-cost power supply.

Pan-American Financial Congress' Proceedings

The unanimous opinion expressed by the delegates to the Pan-American Conference recently held in Washington, D. C., was to the effect that it is essential to the development of trade and improved relations between this country and the Latin-American nations that United States bankers and business men grant ample credits to Latin-America and make prompt provision for the necessary organization and facilities for this purpose, and that the prompt establishment of adequate steamship facilities is "a vital and imperative necessity." In a letter to the President from the Secretary of the Treasury in transmitting the proceedings, the Secretary states that the twelve Federal Reserve banks could, with the consent of the Federal Reserve Board, establish joint agencies in each of the countries of Latin-America. The combined capital stock and resources of our Federal Reserve banks, utilized in this way, he stated, would give them unrivaled financial power. The initiative in this plan rests with the Federal Reserve banks.

The Secretary also recommended that the government of the United States promptly provide the necessary transportation facilities by subscribing the capital stock of a corporation organized for the purpose of owning and operating the necessary steamship lines. He also recommended that the United States International High Commission on Uniformity of Laws, created at the conference, be granted an appropriation of $25,000.

PENNSYLVANIA MEMBERSHIP NOW 1623

Discussion at Bedford Springs Convention of Association Turns on Problems Confronting the Smaller Utilities

The eighth annual convention of the Pennsylvania Electric Association, the banner geographical section of the National Electric Light Association, was held this week at Bedford Springs, Pa. From the reception to President Walter E. Long on Tuesday night to the closing session on Friday, the interest of the delegates was maintained in the proceedings, which this year were given over to a discussion of the problems confronting the smaller utilities. Aside from the main committee reports and one or two papers by manufacturing companies, the program was made up of papers prepared by managers and operators of small systems.

The President's Address

The work of the year was well summarized by President Long in his opening address. An increase of 20 per cent was reported in the number of member companies now enrolled in the association, the total membership now being 1623. Important work was performed by the standing committee, said the president.

PRESIDENT LONG

The rate committee acting in conjunction with the bureau of rates and tariffs of the Public Service Commission has been instrumental in drawing up a complete set of rules and regulations governing the issuance of tariffs, and has submitted these to the commission for its consideration. The engineering committee, agreeable to the suggestion of the chief engineer of the Public Service Commission, has had a number of its members on a joint committee representing the different classes of utilities and has prepared and forwarded to the commission specifications covering the construction at crossings of overhead lines of public utilities.

Special consideration was given the report of the accounting committee which recommended a system of classified accounts for adoption by the Public Service Commission. The standard classification of the National Electric Light Association has been used with such minor modifications as were deemed necessary to meet the conditions existing in Pennsylvania. The basic principles embodied in the national classification have been adhered to, however.

Safety and Welfare Work

The workmen's compensation act becoming effective in Pennsylvania next January, the report of the committee on safety and welfare work was an important document and was discussed by Mr. Samuels of Allentown, H. N. Mueller of Pittsburgh, V. J. E. Shute of Allentown, A. E. Parson of New York City, and A. R.

Granger of Chester. The committee emphasized the fact that welfare work must be mutual to be of real benefit. Unless there is enthusiastic co-operation between employer and employee, welfare work cannot be properly developed. The committee also opposed the belief that too little regard has been paid to the physical fitness of new employees for the duties of the position to which they are appointed. Men should be placed where there is at least a probability of efficient service due to physical fitness. In discussing accident prevention the committee pointed out that an earnest effort should be made to eradicate the general impression existing in the mind of the public that the electrical industry is one of extreme hazard. The general opinion expressed by those discussing the question of accident prevention was that educational methods and demonstrations of first aid are not of themselves sufficient.

Contests for medals were very effective in working up line crews to a high state of proficiency, the men profiting more in two weeks by this means than they had previously learned by two years of demonstration.

Co-ordination of Accounting and Engineering Work

In a paper on the co-ordination of the accounting and the engineering departments presented on Wednesday, Edwin D. Dreyfus of Pittsburgh showed how necessary it is for the engineering and accounting departments to co-operate in determining valuations, depreciations and costs. He suggested three means of securing joint action—meetings and discussions to elucidate in a rudimentary way the procedure necessary to carry out successfully the work of each department; simple notes for exchange describing the elements that must be cared for in fulfilling the functions of the two departments, and diagrams and such other illustrations as will show graphically the true nature of other departments' work, so as to visualize in the engineering department how the equipment is arranged in order to provide for the service, how the operating force is organized to maintain the service, and furthermore how the power supply is divided, and then for the accounting department the manner in which the information and costs are routed in order that all expenses shall be properly distributed and placed on record and afterward reclassified for the various purposes of the business.

S. E. Doane of Cleveland, in discussing the paper, said that engineers make excellent accountants because they make notes rather than write a story.

Closing Sessions of the Convention

Thursday and Friday the following papers and reports were read and discussed: "Opportunities for Central-Station Steam-Heating Development," by J. Grant Dermerer; "Protection of Distributing Transformers Against Lightning," by R. T. Wagner; "Efficiency of Boiler-Room Methods," by H. B. Bryans and John C. Scholl; report of the rate committee, by George B. Tripp; report of the engineering committee, by George E. Wendle; report of a special committee, by R. S. Orr; "Relations Between Electrical Utilities and Their Customers," by J. Fred Schaffer; "The Use of Small Motors on Central-Station Circuits," by B. Lester; discussion on handling of cases involving theft of electricity; "Electrically Operated General Utility Devices," by S. H. Blake; "Factors Entering into the Supplying of Rural Communities from Adjacent Central Stations," by W. H. Acker, and discussion on methods of obtaining right-of-way on public highways.

On the recommendation of the nominating committee, Stephen C. Pohe of Bloomsburg was elected president for the ensuing year.

INDIANA ELECTRIC LIGHT ASSOCIATION

Reports Show Increase in Lighting Business Throughout State—Affiliation with N. E. L. A. Discussed

Many papers on different subjects, supplemented by various entertainment features, made up the program for the seventh annual convention of the Indiana Electric Light Association, which began a three-day session on Wednesday, Sept. 8, at the Hotel Deming, Terre Haute, Ind. After preliminary committee meetings the delegates heard the welcome of Mayor Gossom.

President Comments on Business Conditions

In the annual address the president, T. F. Grover of Terre Haute, said that for many members the past year had been a strenuous one. The general depression

PRESIDENT GROVER

in business on account of the European war, however, and the attitude of the general public toward public utilities, added to the problems arising through commission regulation, have not only failed to check the progress of the industry but have been met with increased effort. Statistics show a decided increase in output and earnings of electric light and power companies in the territory served by members of the association.

Customers have shown their appreciation of the fact that lighting companies have not hesitated to give them the entire benefit of the saving due to the tungsten lamp and have used more electrical energy. Many new customers have also been added. With the general use of the nitrogen gas-filled lamp, the customer again has had the full benefit of a reduction in the cost of illumination. "Notwithstanding an increased service for a greatly reduced cost to the consumer, there is still," said Mr. Grover, "a popular demand for lower rates." This, like other questions affecting the industry, will be met in a spirit of justice. Mr. Grover declared that he was proud to assert that no other business can boast of so large and continued reduction in cost to customers, while maintaining at the same time such a high standard of service and paying more for labor and supplies.

The industry is a long way from the end of improvements and additions, and Mr. Grover predicted that in a comparatively short time electricity will supplant all other appliances for cooking in the home as well as in restaurants and hotels.

Following a recommendation made by President Grover, it was decided to consolidate the offices of secretary and treasurer. A revision of dues was also approved. The report of Secretary Thomas Donohue showed that the association is in good financial condition.

Affiliation with N. E. L. A.

The question of affiliation with the National Electric Light Association was discussed by S. W. Greenland, Fort Wayne, and it was decided to refer the matter to the executive committee, which will investigate the arrangements affecting sectional associations and take action. The association has now a total of 105 members, of whom fourteen were added during the last year. In connection with the committee reports, the poetical form of the remarks of J. W. Robb, chairman of the committee on good fellowship, attracted much interest.

At the afternoon session President Grover read a letter from Chairman Halford Erickson of the Wisconsin Railroad Commission, expressing regret at the pressure of business which made it impossible for him to present a paper on "Investment and Returns."

A paper on "Stability in the Electric Light and Power Industry" was read by Frederic Nicholas, associate editor of the ELECTRICAL WORLD. In this paper, which is reproduced in full on page 572 of this issue, was discussed the growth of the electric central-station industry and the desirability of co-operation between the public service commissions and companies, in order that the credit standing of the properties may be preserved. Meeting upon the middle ground of fairness to both public and investors, the commissions and companies will relieve the present tension in business and further the development of an industry which is of inestimable value to the country.

In the discussion, Mr. Alexander R. Holliday, Indianapolis, dwelt upon the rates which central-station companies have to pay for capital. As showing the unwillingness of local investors to finance their own utilities, he cited an instance where bonds offered directly to the public at a yield of 7.2 per cent were not taken. F. A. Bryan, South Bend, cautioned companies operating small properties against too much dependence on one customer. C. C. Perry, Indianapolis, said that central companies should pay more regard to the diversity factor. J. W. Robb, Clinton, spoke of the need for a fair rate of return corresponding to that obtained by bankers. E. J. Condon, Angola, discussed attacks on rate schedules and the apparent tendency on the part of some of the authorities to refuse an adequate rate of return. President Grover discussed the difficulty of raising capital for extensions.

Ways to Determine Customers' Demands

Emmet Ralston, Indianapolis, read a paper on "Methods of Determining Maximum Demands for Rate-Making Purposes." The best procedure is a combination of methods. The demands of small consumers can be estimated in accordance with predetermined rules. Further, the peak loads of customers could be often determined from simple indicating tests and a periodic changing of their operating conditions, while for others periodic, graphic or printometer tests would be required. Those who on account of the nature of their business and operations have extreme fluctuations in demands from day to day should be equipped with a permanent demand indicator. There is a practical limit beyond which a company should not go in defining demand. Much discussion followed, and it was agreed generally that difficulty is found in making the basis of rate-making clear to many of the consumers.

It was decided that the committee on standardization should take up the question of maximum demand and consider whether or not it will be possible to fix a maximum demand that will fit all cases. The entire question of rate-making is based on customers' demand. Among those who discussed the paper were F. A. Bryan, Thomas Donohue, C. C. Perry, J. P. Ohmer, E. J. Condon, F. R. Stockwell, T. F. Grover and J. T. Kester.

A paper by Q. A. Brackett, Westinghouse Electric & Manufacturing Company, on "Some Off-Peak Loads—Charging Electric-Vehicle Batteries," was read in his absence by F. H. Nealis of the same company. This paper showed the importance of building up the off-peak load, which is of two classes, day load and night load. Central stations have done much toward increasing the off-peak day load. This has largely taken the form of pushing the sale of electric heating and cooking appliances and the development of the motor load. The former has the fault that it depends on the use of small units and the motor load is frequently of low power-factor. To fill in the light load period between midnight and morning, however, little has been accomplished, although this period needs attention most of all. The first thing that a central station must do to increase the use of electric vehicles is to make special rates for energy when used for off-peak charging and advertise this fact conspicuously. The second step should be to educate the public on the advantages of the electric vehicle and its real economy over other types.

The remaining sessions of the Indiana convention will be reported in a later issue.

NORTHWEST ASSOCIATION AT PORTLAND

Public Relations, the Small-Customer Problem and Electric Cooking Among Topics Discussed

More than 150 delegates from the Pacific Northwest, including many from California, attended the eighth annual convention of the Northwest Electric Light and Power Association, which opened at Portland, Ore., on Sept. 8. Following the call to order by Franklin T. Griffith, president of the Portland Railway, Light & Power Company, Mayor H. R. Albee of Portland delivered an address of welcome, and President O. B. Coldwell of the association presented his official address.

Address by President Coldwell

In the course of his carefully considered discussion of the affairs of the Northwest association, President Coldwell referred to the activities of the organization during the preceding twelve months and spoke in complimentary terms of the work of the committees. Public relations of utility companies, the relations of the Northwest association with the National Electric Light Association, co-operation with electrical contractors, etc., were among the topics also treated in the address.

PRESIDENT COLDWELL

The speaker recommended giving more attention to studies of the actual cost of service for ascertaining various classes of rates, including the valuation of the property utilized. He urged that particular attention be given to the subjects of heating and cooking with electricity, and pointed out the general educational and publicity value resulting from getting teachers and school children interested in electricity.

E. W. Lloyd, president of the National Electric Light Association, spoke next, telling briefly of what the national association has done during the past year toward getting all sections of the country unified in the work of electrical development. He dwelt especially on the point that the national association presents a wide field for effort on the part of geographical sections and member companies, and declared that if the people in any section feel they have not had the fullest co-operation on the part of the association they are in a measure responsible for not taking more interest in the organization. President Lloyd said that the quickest way to get the national association to take an interest in local matters is for the local section to take an interest in general association matters.

Educating the Public

L. R. Alderman, superintendent of schools for the city of Portland, addressed the meeting briefly, telling of the new Portland polytechnical school and inviting members to visit the city's trade schools and see work now being done toward getting pupils interested in practical electrical subjects. He suggested that the association have its representatives in various towns co-operate with local school officials for the purpose of instructing teachers and children in the progress in the art, especially in electrical heating and cooking.

Resolutions were presented before the convention urging the federal government to proceed as speedily as possible toward securing a workable water-power law, and also commending Electrical Prosperity Week and the work of the Society for Electrical Development. Resolutions were also presented urging that members of the association co-operate with school officials in getting electrical subjects properly presented to students in schools, as well as in getting students drilled and familiar with safety-first principles, especially as related to resuscitation from drowning and electric shock.

Afternoon Session

At the afternoon session the first paper read was that on "The Small Consumer Question," by H. E. Eisenmenger of the National Lamp Works of the General Electric Company, Cleveland, Ohio. A full discussion followed the reading of this paper, an abstract of which will be presented later in these columns.

John A. Rockwood of the Portland Railway, Light & Power Company also read a paper on "Cost Apportionment as Applied to Classes of Service," in which he showed how actual cost to the utility could be determined for all classes of service.

Cooking with Electricity in the West

The report of the committee on electric ranges, consisting of W. R. Putnam, chairman, M. C. Osborn and S. V. Walton, was one of the features of the Portland convention.

On July 15 the committee mailed 353 central stations in the States of Montana, Wyoming, Colorado and New Mexico and all States west thereof a list of thirty-six questions. By Aug. 10, 161 replies thereto had been received.

These reports from central stations show a total of 389,842 residence electric-lighting customers. Of these, 220,042 are using gas for fuel and 2481 electricity, leaving 167,319 homes which use some other form of fuel than gas or electricity. The committee feels that 50 per cent of this last number should become electric-cooking customers during the next five years, provided that there is a proper understanding of the importance of this business and efficient co-operation on the part of the central stations and the manufacturers of ranges.

Essentials for Development of Electric Cooking

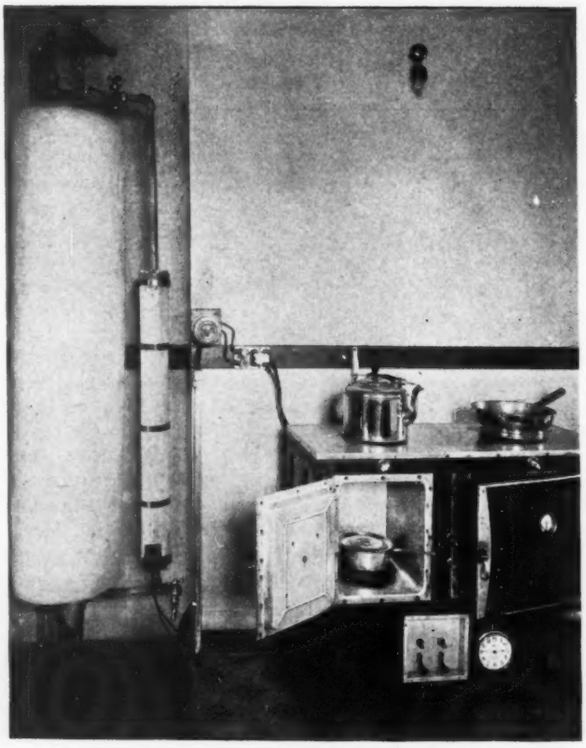
The securing of this amount of business depends upon having:

1. Economical rates for electric cooking.
2. Moderately priced and yet efficient cooking and water-heating equipment.
3. An active publicity and selling campaign, handled jointly by the central stations and the manufacturers.

The general opinion of all who have investigated electric cooking is that a 3-cent rate for this purpose, with 10 per cent cash discount, is necessary to compete with other fuels. On a basis of heat units alone electricity at this price cannot compete with other fuels, but, owing to its much more efficient mode of application and to the lesser shrinkage of electrically cooked foods, it is the opinion of the committee that this rate can secure the business, particularly if range manufacturers use fireless-cooker features in their ranges and if customers use flat-bottomed utensils on the top plates of the range.

Water-Heating Service

In the opinion of the committee, water heating cannot be done economically at 3 cents. With the present style of heaters a rate of from 0.75 cent to 1 cent is necessary. This is too low to be profitable and its only justification is its necessity in order to secure the cooking load at the higher rate. Especial attention should be given in the future, as is now being done, by the manufacturers to the development of more efficient water-heating devices.



A CLOSE APPROACH TO A UNITY LOAD-FACTOR INSTALLATION

Electric range and water heater on lines of Pacific Power & Light Company, so arranged that the heater is automatically disconnected when the range is in service.

If possible, electric water heating should be done by heaters of low wattage connected to the system either from 11 p. m. to 7 a. m. or at all hours of the day excepting when the range is in use. This will necessitate a double-throw switch at the customer's installation and will require exceptionally good lagging of customer's water tank and pipes. The advantage of this arrangement is the securing of either an "on-valley" load or a twenty-four-hour load from residence customers, which will effect a considerable saving in investment on the part of the central station and will be a justification for whatever rate may be finally determined upon as necessary for this business.

Suggestion for Combination Rate

The committee believes that the final residential rate will be a block rate, with fairly high minimum bill, thus allowing the central station to furnish all service in the house through one meter. In this connection there is cited the rate designed for this purpose by the Buffalo General Electric Company, which follows this schedule: 8 cents per kilowatt-hour for first sixty hours' average monthly use of maximum demand; 5 cents per kilowatt-hour for next 120 hours; 1.5 cents per kilowatt-hour in excess of 180 hours. No maximum demand figured less than 250 watts. Maximum demand shall be figured as 25 per cent of total installation, not including irons, heating devices, cooking devices, fans, vacuum cleaners and utility motors not exceeding 0.5 hp. in size. A discount of 1 cent per kilowatt-hour consumption will be billed on primary rate, and there will be a minimum charge of $1.

In preparing such a rate some arrangement must be made to have the resulting costs to customers equitable as between different-sized homes and yet not so complicated as to be confusing.

With 389,842 homes covered by this report, each paying the central station an average of $20 per year for electric-lighting service, there should be appreciated the immense field for additional earnings, on the companies' part, with a correspondingly small increased investment, from the use of lamp-socket appliances, washing machines, vacuum cleaners, sewing-machine motors, utility motors, air heaters, water heaters, refrigerating machines and electric ranges.

The central station cannot expect to increase the household expenses of its customers, but it must avail itself of every opportunity to substitute electricity for other agents in their homes, particularly when by so doing it materially improves home conditions.

Earnings of $60 per Year per Customer

Eventually the central station will secure average earnings of $60 per year from a large portion of its residence customers, and this increase of $40 per customer can be secured by an investment on the central station's part of less than $70 per customer, including plant, transmission and distribution system. Meanwhile the operating expense per customer has very slightly increased, especially so in the case of hydroelectric plants.

In every instance where commission regulation is in force in the Western States, the committee finds that the commissions have approved low rates for cooking, apparently on the basis of "value of service.'" As yet the committee has been unable to find a single instance of serious objections on the part of customers using electric service for other purposes to the low cooking or heating rates.

Competition with Gas

The following statement was submitted to the committee by a combination gas and electric official as representing the attitude of combination gas and electric men:

"When the average efficiency of use of gas and electricity is taken into consideration the following table shows the rates for each that are comparable:

Gas, per 1000 Cu. Ft.	Electricity per Kilowatt-hour, Cents	Gas, per 1000 Cu. Ft.	Electricity per Kilowatt-hour, Cents
$0.75	1.25	$1.75	2.92
0.90	1.50	2.00	3.33
1.00	1.67	2.25	3.75
1.25	2.08	2.50	4.17
1.50	2.50		

Selling Policy for Electric Ranges

Under present conditions of range prices, lack of demand on part of customers, and general newness of electric cooking, the committee feels that it is necessary for central stations to do the bulk of the selling of ranges. However, as range prices go down, central stations should maintain their selling prices, so that electric supply dealers and hardware stores can sell ranges at a reasonable profit.

Ranges should be sold on time payments extending over six months or preferably one year. In case dealers are handling ranges the central stations may be obliged to finance their time payment sales; the cash price should be 10 per cent less than the time price.

If possible, costs of wiring should be worked out so that an average is determined and this should be added to the range price, so that when a sale is made the customer signs a contract containing a specified amount for the whole installation cost. In some instances, and particularly as an introductory argument, central stations may find it advisable to absorb the wiring cost, The selling policy in regard to water heaters should be the same as for ranges.

Magnitude of Opportunity—Publicity Needed

With a total of some 160,000 homes to be supplied with electric ranges at say an average return to manufacturer of $35 apiece, the same number of water heaters at an average of $9 apiece, and a sale on the part of the manufacturer for each range of $12 in transformers, $8 in meters and $30 in supplies, the committee feels warranted in urging upon the manufacturer an exceedingly active co-operation in the development of this business.

"We want so to present the advantages of electric cooking to customers that they will come to us demanding electric ranges instead of our having to use days of a salesman's time to secure one customer's order for a range," declares the report. "Our advertising must be aimed at this end as follows:

"1. Newspapers. Live, snappy advertisements and stories can be used here to advantage.

"2. Booklets, circulars and post cards. These are of great importance, particularly cook-books devoted to electric cooking and post cards featuring electric cooking in a catchy way and mailed systematically to all 'prospects.'

"3. Demonstration work. This is especially necessary in introducing cooking, as nothing impresses the housewife who knows nothing of electric cooking so much as the actual cooking in her presence. However, if the experience of gas companies is a criterion, we can use demonstration to advantage for many years to come.

"4. Cooking experts to follow cooking installations. This is of particular importance, as many housewives require several visits for instruction before they grasp the economical handling of their range, and if this is not done, we are almost sure to have a lost customer, who will do us more harm than many satisfied customers can do good."

The closing sessions of the Northwest convention will be reported in these columns next week.

Radio Telegraphy and Telephony for Railroads

Experiments on Lackawanna Railroad Show Possibilities for Wireless in Train Dispatching and for Emergency Work

BY JOHN L. HOGAN, JR.

SINCE the beginning of experiments in wireless telegraphy for railroad service by the Delaware, Lackawanna & Western Railroad, in 1913, there has been ample opportunity to prove the value of radio equipments for provision of an emergency telegraph service. When wires fail, because of sleet storms, washouts, wreck or other line-destroying occurrences, it is found not only convenient but extremely valuable to be able to communicate between the main dispatching points of the railroad by means of wireless. On several occasions the Delaware, Lackawanna & Western has averted extended tie-ups by such use of the radio equipments, and following these practical demonstrations installations have been made at Hoboken, Scranton, Binghamton and Buffalo. The Buffalo station at present has receiving apparatus only, pending completion of a new and permanent aerial structure. Hoboken is fitted with a 5-kw. Marconi set and has a 400-ft. tower supporting the antenna. At Scranton and Binghamton* 2-kw. Marconi sets are installed, with antennas hung with an average height of about 175 ft. It is intended that a 400-ft. tower shall be erected at Buffalo, so as to permit reliable signaling in both directions between that point and Hoboken. Experiments made between the National Electric Signaling Company's plant at Brooklyn and the Delaware, Lackawanna & Western station in Buffalo have shown that 10 kw. of sending power is ample to give good signals over the distance of about 400 miles, under average daylight conditions.

FIG. 1—WIRELESS TELEPHONE OUTFIT ABOARD LACKAWANNA LIMITED TRAIN

In addition to this work on radiotelegraphy as an emergency auxiliary to through wires, the Lackawanna has experimented to some extent on wireless signaling to and from moving trains. It has been found that where the traffic or other economic considerations involved warrant the expense of employing a Morse operator, installations of standard commercial radiotelegraph outfits aboard the trains will allow reliable communication over distances of about 50 miles. The fixed charge of operator's salary, however, may be the one element of cost which under some conditions will make radio equipment of trains impracticable. With this possibility in view the telegraph and telephone department of the Lackawanna has recently been experimenting with a radiotelephone equipment aboard one of the New York-Buffalo "limited" trains. A similar wireless telephone installation has been made at Binghamton, for two-way testing. Since a properly operating radiotelephone can be manipulated by any member of a train crew, by following simple directions and without need of special Morse training, complete success of the present experiments would result in the possibility of wireless signaling with moving trains at reduced operating cost.

If, however, the wireless telephone is to compete with the wireless telegraph for this work, the telephone must prove its reliability and efficiency. The telephone apparatus, to insure its adoption, must be simple in operation and must give good articulation and clear, loud speech at distances of about 50 miles without requiring the use of extremely delicate receiving instruments. In other words, the telephone which the railroads desire is one which will duplicate the already well-demonstrated performance of the wireless telegraph and in addition obviate the need of a Morse operator.

The Lackawanna's first experiments in radiotelephony have been made with instruments manufactured by Dr. Lee de Forest. The installation aboard the train comprises a complete transmitter, receiver and amplifier, while that at Binghamton is identical except for a change in the source of power and the omission of the amplifier. On the train steam at from 80 lb. to 120 lb. per square inch is led to the baggage car directly behind the locomotive, through a special hose and fittings, and there fed to a Terry 5-hp., 2500-r.p.m. turbine directly connected to a seventy-two-pole 3000-cycle-per-second inductor alternator of the Radio Telephone & Telegraph Company. This combined unit, which is shown in Fig. 2, is installed in a special compartment at the forward end of the baggage car. Field and armature circuits of the 3000-cycle alternator are carried to the next car in the rear, where the radio apparatus is installed as shown in Fig. 1. From these instruments wires run to ground, via the car wheels, and to an antenna consisting of three parallel wires run along the roofs of four adjacent cars and flexibly connected. In the original radiotelegraph work two wire antennas were used, but an increase of efficiency was later gained by adding the third wire along the central line of each car.

The stationary installation was first made at Scranton, and, as shown in Fig. 3, consists of substantially the same instruments as those used on the train. This outfit was later moved to Binghamton, where somewhat better results were secured through the use of an antenna more suited to the design of the instruments. The fixed transmitter secures its power from a similar 3000-cycle alternator, which, however, is motor-driven.

The circuits of the transmitter and receiver as used on the train, according to the De Forest Company, are

*"Radio Service on the Lackawanna Railroad," by John L. Hogan, Jr., ELECTRICAL WORLD, Jan. 10, 1914, page 89.

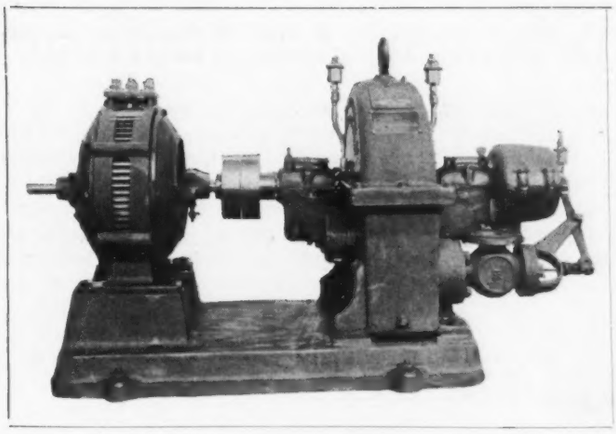


FIG. 2—3000-CYCLE INDUCTOR ALTERNATOR WITH TURBINE DIRECTLY CONNECTED

shown in Figs. 4 and 5. Considering the transmitter, it is seen that from the alternator G the field circuit is led to S_2 and the armature to S_1, which are mechanically interconnected with the small antenna switch shown to the right of the microphones in Fig. 3. With this switch in one position all circuits are arranged for talking and the receiver is disconnected. In the reverse position the transmitter circuits are opened and the receiver made operative. The 3000-cycle current, after passing S_1, is led serially through the line condenser C_1 and the primary of power transformer T, both of which may be seen beneath the transmitter cabinet in Fig. 3. The secondary or high-voltage coil of T is connected directly across three very short tungsten electrode spark-gaps in series, each consisting of parallel surface disks about ¾ in. in diameter, separated about 5 mils (adjustable) in open air and having cooling flanges. Across the spark-gaps G are connected the air condenser C_2 and the variable spiral inductance L_1, which determine the wave-length of transmission. Inductively coupled to L_1 is the secondary spiral L_2, also variable, which has one terminal connected to the antenna A and the other to earth E, through a small ammeter I and two Berliner microphones M in series. In operation the meter reads about 1.7 amp. normal, which is reduced to about 1.3 amp. by talking into the microphones. A small buzzer is arranged with push-button so that the carbon of the microphones may be agitated occasionally to prevent packing, and a short-circuiting switch is provided in order that an external "chopper" or antenna circuit interrupter may be used for telegraphic purposes.

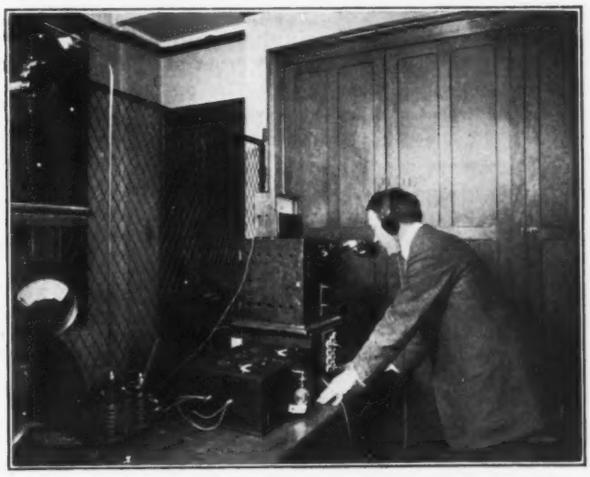


FIG. 3—RADIOTELEPHONE INSTALLED AT SCRANTON, PA.

The receiving apparatus (Fig. 5) comprises the usual two-circuit tuner (mounted in the base of the telephone cabinet) and an audion detector. A represents the antenna, L_3 a variable loading coil, C_3 the antenna series tuning condenser, L_4 and L_5 the coils of an inductive coupler, C_4 the secondary tuning condenser, C_5 the blocking condenser, V the audion with auxiliary batteries B_1 and B_2 and telephone receivers T_1. On the train a three-step audion amplifier is interposed to magnify the tele-

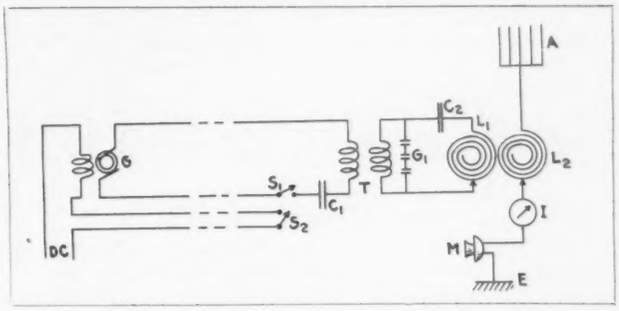


FIG. 4—WIRING DIAGRAM OF WIRELESS-TELEPHONE TRANSMITTER

phone currents, but at Binghamton it is found inadvisable to use the increased sensitiveness thus obtainable, on account of the great responsiveness to static simultaneously produced.

Some exceptionally good results are stated to have been secured by the use of this apparatus. Receiving from Binghamton, the train operator has copied telephonic messages as far as Lounsbury (26 miles) to the west and Foster (34 miles) on the east. From Scranton east the train has exchanged telephonic messages as far as 50 miles. The train operator has reported passing each station in a zone of 40 miles, for the records of the division dispatcher. Messages have been transmitted a number of times between the fixed stations at Scranton and Binghamton, 63 miles apart, and at night time the Binghamton sender has been heard by a station 67 miles away, at New Berlin, N. Y.

The performance of the radiotelephone apparatus appears to vary somewhat from day to day. Some weeks ago the writer was invited by the Delaware, Lackawanna & Western to witness tests of the installations, and it was not found possible to duplicate the best work

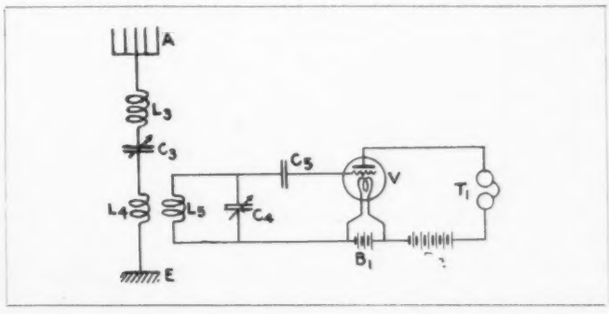


FIG. 5—WIRING DIAGRAM OF WIRELESS-TELEPHONE RECEIVER ON TRAIN

previously accomplished. The operator at Scranton heard the westbound train from Cresco (27 miles). Approaching Binghamton, the fixed telephone was heard as far as New Milford (20 miles), but the spark was too noisy for words other than "Hello" to be understood. At about 15 miles distance such phrases as "I heard what you said" and "I have not got a newspaper here" could be deciphered. There was no difficulty as to intensity of signals; whenever the voice was heard it was

loud, but articulation was spoiled by the strong irregular spark noises or improper operation of the microphones.

In spite of irregularity of operation, however, the fact that radiotelephonic communication has been repeatedly obtained to and from moving trains over distances of 25 miles or more is well worthy of note. It remains for designers and builders of wireless-telephone instruments to supply apparatus which can be relied upon for consistently good service. Possibly the difficulties which have been developed by the tests on the Lackawanna are caused merely by lack of harmony in detail; if so, there should be little time required to eliminate them and to provide a uniformly excellent service. Perhaps, however, the troubles are not superficial but inherent in some element of the transmitter such as the microphone. In this event considerably more experimental work will be required before commercial service can be provided by telephone. Until such time as the railroads are convinced of the radiotelephone's ability to meet their requirements, however, as the Delaware, Lackawanna & Western points out, train communication over fairly long distances can always be obtained by the radiotelegraph, provided that a Morse operator is available.

Stability in the Central-Station Industry*

Causes Which Have Contributed to the Earning Power of Electric-Lighting Companies and Elements Which Make for Future Growth

BY FREDERIC NICHOLAS

NO conservative would have said that the electric light and power industry, in its early days, was firmly established. It was then a business essentially for the pioneer and promoter. It was a venture concerning which no predictions could be made with the certainty of experience. Possibilities, perils, profits, losses, costs were elements of unknown degree. Such characteristics are common to the pioneer days of all industries, yet they are the inevitable inspiration which leads the experimenter forward. Although we may regret the over-enthusiastic excesses of the promoter, the first steps of an industry belong to him because he alone foresees and has courage to embrace the chance involved. Without him the later years of establishment as an institution and of permanence could not follow.

With the initial promotion period over, phenomenal development started. The rapid unfolding of wonderful opportunities in new and broadening fields was a source of strength in the early years, and it has so continued to this day.

With less of the glamour and hazard of the promoter, there came as time passed more assurance of that virility which is the ultimate aim of a permanent business. This was the dawn of a new commercialism, the extension of markets by sales campaigns and solicitation, the opening up of new markets, the careful search for every possible consumer and the large and systematically diversified load. To trace the development even roughly would be less convincing than to quote the evidence available.

Surprising Progress Made

From 1902 to 1912, according to the Bureau of the Census report on commercial central electric stations, cost of construction and equipment increased 334.7 per cent, outstanding capitalization increased 227.1 per cent, gross income increased 254.2 per cent, and output in kilowatt-hours increased 375.8 per cent. The rate of progress in some other industries during the decade from 1889 to 1909 is also shown by census reports and is of interest by way of comparison. The agricultural implement industry increased in capital 62.5 per cent and in value of products 44.6 per cent. Slaughtering and meat packing gained 101.5 per cent in capital and 73.8 per cent in value of products. The lumber industry increased 57.1 per cent in capital and 50.1 per cent in value of products. The manufacture of chemicals and allied industries showed a gain of 102.8 per cent in capital and of 109.9 per cent in value of products. In gas manufacture there was a gain of 61.5 per cent in capital and 120.3 per cent in value of products. The woolen industry, exclusive of carpets and rugs, increased in capital 62 per cent and in value of products 75.2 per cent. The boot and shoe industry increased 101.4 per cent in capital and 76.8 per cent in value of products. The paper and wood-pulp industry showed an increase of 144.4 per cent in capital and 110.2 per cent in value of products. From 1902 to 1912 the capital of national banks increased 48.3 per cent, and bank clearings reported by the leading clearing house associations increased 45.2 per cent. In the same period the cost of construction and equipment of street and electric railways increased 112.1 per cent and gross income of operating companies increased 133.9 per cent. It will be noted how greatly the record of central stations surpasses that of any other industry. The figures quoted show surprising progress, and indicate a still greater future for the electrical industry.

Growth Despite General Business Depression

The ELECTRICAL WORLD returns cover the gross income and kilowatt-hour output of a substantial percentage of the industry since May, 1914. The fact of chief significance which these statistics show is that in no month has there been a decrease, as compared with the corresponding month of the previous year, in either total financial income or total kilowatt-hour output. For the different months beginning with May, 1914, the increase in income has ranged from as high as 9.1 per cent to as low as 2 per cent. The output of kilowatt-hours has increased in the same months from a maximum of 13.3 per cent to a minimum of 0.8 per cent. The figures are conclusive as to the temper with which the shock of the terrible European war was withstood. To maintain gross volume and to do a little more is an achievement. The total gain of roughly 5 per cent per year in both financial income and kilowatt-hour output which the statistics indicate would represent in many industries the normal increase attainable in good times. The figures carry greater emphasis when it is remembered that capital expenditures for extensions and betterments were not made at the usual rate.

Of first importance in an inquiry as to the probable continuation of such a record is the stability of markets, the question of whether or not a demand is assured. Of the fact that the service rendered to consumers is neces-

*A paper presented at Terre Haute this week before the Indiana Electric Light Association by Mr. Nicholas, who is a member of the editorial staff of the ELECTRICAL WORLD. In his paper Mr. Nicholas discussed the elements which have a bearing on the financial stability of the electric-lighting industry and showed the influence of rates and regulation on earnings.

sary there is ample evidence. From lighting to the larger field of energy for motor service in broad industrial markets, it is essential. Continued upbuilding to large outputs and steady extension in diversity of customers have been factors which the industry has appreciated and worked for, and these are well calculated to increase strength.

Some consumers of electric energy manufacture goods which are so highly sensitive to business conditions that disturbance closes their markets; but the diversification provided by many industrial and residence customers saves central stations generally from the distressing results of commercial unrest. If one industry is affected adversely, another, as is shown by war orders, remains normal or is speeded by day and night. It was supposed popularly that the "prosperity" automobile manufacturers would be affected fatally by the destructive conflict across the ocean, but they have had unparalleled orders, leading to a substantial addition in the demand upon electrical utilities.

Steadiness of Demand

Even where central stations are established in communities that are largely dependent upon one industry alone or one class of industries, the introduction of commercial ideas lessens the results of depression and adds qualities of lasting strength. In the great body of central stations proved steadiness of demand assures maintenance of output. Constant growth in the needs of customers and revelations of new uses more than overcome deflections. In the last disquieting year notably successful results have been attained by companies which built up in new business more than they lost in reduced or discontinued consumption by old customers.

Until the actual and attainable consumers are served fully, the electrical utility—barring war, world-wide cataclysm or other unsuspected influence—will continue to become more powerful in those factors that contribute to permanence of output. Its supporters will develop and encourage greater uses of service by old customers and new uses by new customers. A characteristic illustration of what is being done in the industry is the enterprising plan of the Society for Electrical Development for celebration of "Electrical Prosperity Week."

Rates and Regulation

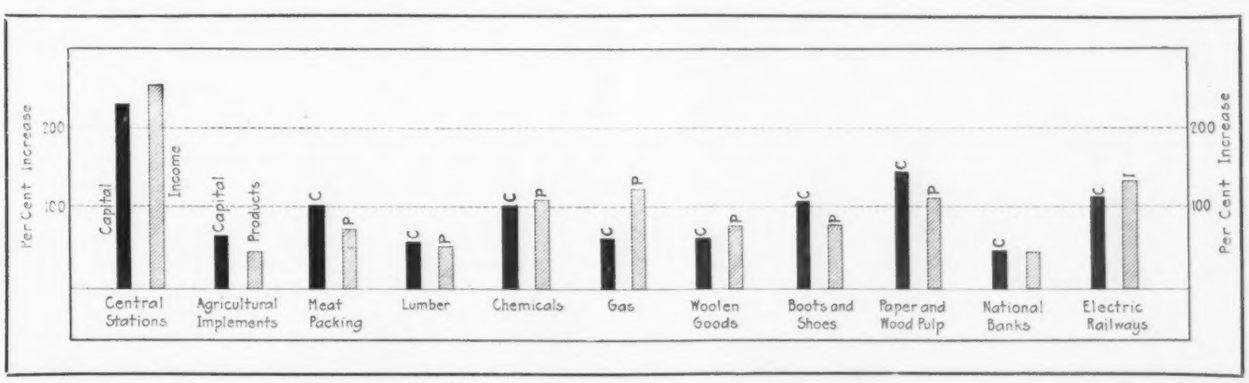
The next most important element is steadiness or increase of revenue and income. Only when rates are protected from unreasonable and sudden changes can maintained earnings be assured. The central station, however, does not need inflexible rates. It has developed commercially because of broadened service and flexibile rates graded and adjusted to meet varied requirements of customers. Electric-railway rate-making, which is more rigid, corresponds to the government charge for a letter delivered either in one's home city or across the continent, both expecting an average cost of trip less than the amount received. This is not offered as a criticism of electric-railway rate-making, but in order to recall the essential difference. The central station has not sought to hold rates firmly, yet it has had unquestioned stability of earnings. Its average rate and the charges for most, if not all, classes of business have been continually lowered. Absolute rigidity never would have encouraged or supported the phenomenal development that has taken place. A uniform rate would not have done it. Only enterprising principles of merchandising and engineering salesmanship could have produced the large earning power which has been attained. Lowered cost of production has been an influence, but in a summation of causes the cultivation of the high load-factor is a most potent element.

Earnings and Decreasing Rates

The evidence that earnings have been maintained with decreasing rates is no guarantee that the end of this process will not be reached. New markets requiring vast increases in production may be developed to cheapen cost, new ways of reducing cost may be discovered or invented and made practicable, but present costs, obligations and conditions and standards of service mean that revisions of rates should be undertaken only after very thorough analysis. The foundation of an adequate level of earnings is rate-making controlled by scientific investigation and directed with mathematical regard for all of the considerations involved in changes.

Central stations must also meet without discrimination the commercial requirement of getting and holding the business and of developing new markets. Befor the era of public service commission regulation, although frequently a maximum rate was prescribed by city ordinance, most of the rate-making was done by the companies without interference from the constituted authorities. Working below the prescribed maximum limit they achieved commercial success. With the entrance of commissions and rate-making by public authorities the companies have less jurisdiction over this vital matter.

The consideration to be faced now is the important one that some of the conditions which have been controlling in the past may not be found in the future. Commissions have a direct influence, and the war, although external, will have an effect whose full bearing cannot be foretold. Central stations should seek to avoid sudden unjustified changes in rates that might impair both earnings and the ability to raise more capital. In building and maintaining their rate struc-



INCREASES IN CAPITAL AND IN VALUE OF PRODUCTS OF VARIOUS LEADING INDUSTRIES DURING RECENT TEN-YEAR PERIODS

tures they need the application of broad principles and commercial insight. In all probability capital cannot be borrowed as freely or on so easy terms as in the past years. The devastation of war and the great demand for loans to aid in reconstruction will impose heavy burdens upon money markets.

Necessity for Good Credit Standing in Future

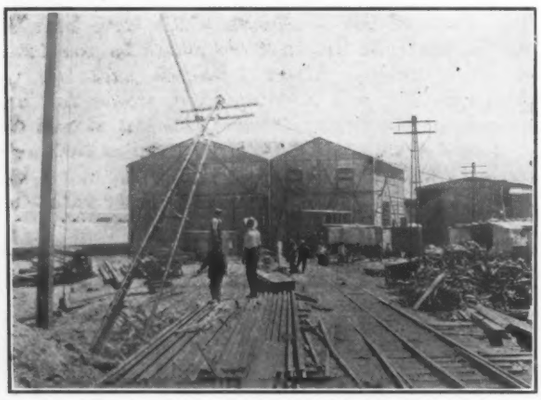
In the necessity of the service which they are rendering, in the certainty of wide and stable markets, central-station companies, based as they are on a sound and large economic principle, have the substantial foundations which apparently are capable of sustaining a powerful, prosperous business, of great and lasting value to the public. But to provide the extensions which will be expected when the world again has peace and good-will they must command capital. To be preferred borrowers they will require all of their past strength undiminished by needless uncertainties. In preserving a credit standing which has enabled these properties to finance on terms of increasing advantage to themselves as well as to the public, commissions and the companies, acting in co-operation will produce immeasurable results. It is most important that they shall meet upon the middle ground of fairness to both public and investors, and by so doing they will relieve the present tension in business and further the development of an industry which has proved itself to be of inestimable value to the country.

TRANSMISSION TOWERS OF 3-IN. PIPE

Structures Hastily Improvised from Materials on Hand to Take Place of Delayed Shipment of Standard Towers

Owing to the delayed delivery of a number of steel transmission towers by reason of the war in Europe, half a dozen inexpensive strong towers were improvised by engineers of the Chile Exploration Company at Chuquicamata, Chile, from ordinary 3-in. pipe to carry some very heavy and important 500-volt lines which it was desired to put into active service with the least possible delay.

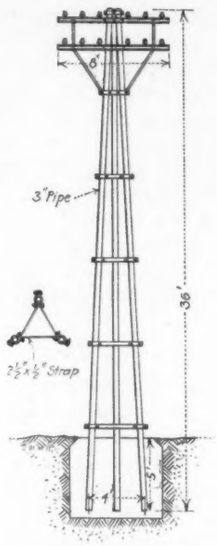
The towers were built of ordinary 3-in. pipe solidly



RAISING ONE OF THE IRON-PIPE TOWERS INTO PLACE AT CHUQUICAMATA, CHILE

framed together by means of clamps made of 2.5-in. by 0.375-in. scrap iron. Of the 36-ft. total height of the towers, about 5 ft. was set in concrete. Cross-arms were made of 4-in. channel iron stiffened by 1.5-in. by 1.5-in. by 0.185-in. angle-iron braces. These towers were designed to support six No. 0000 stranded conductors on the top cross-arm and six 400,000-circ. mil. conductors on the lower cross-arms. The average span was 110 ft., the insulators being spaced 15 in. apart. The accompanying halftone shows two of these improved towers installed in place and the third in process of being erected.

Mr. E. Heybroek, who acted as electrical engineer for the Chile Exploration Company at its Chuquicamata



ELEVATION OF IRON-PIPE TRANSMISSION TOWER, SHOWING METHOD OF CLAMPING MEMBERS

plant, calls attention to the rigidity of these iron-pipe towers as evidenced by the straight lines of the longitudinal members of the tower which is shown in an inclined position during erection in the accompanying halftone illustration.

"Doing It Electrically" at West Point

By John A. Randolph*

Electricity is a twenty-four-hour servant 365 days a year at the United States Military Academy at West Point, N. Y. It not only furnishes the light for streets and buildings, but performs much of the work in the bakery, kitchen, pantries, laundry, tailor shop, barracks and other departments.

In the bakery it does all the heavy work in the mixing and kneading processes used in the preparation of bread and pastry.

In connection with the kitchen and auxiliary departments, electrically driven machinery peels the potatoes —several bushels at a time; freezes ice cream, chops meat, washes dishes, pasteurizes milk, chops ice, grinds knives, polishes tableware, and performs numerous other functions in the preparation of food.

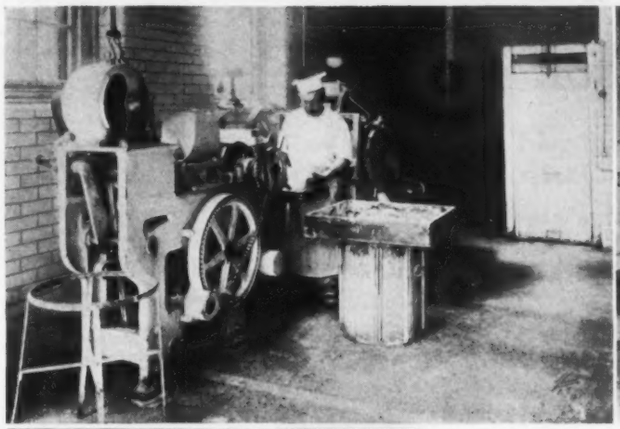
A "Kitchen King" driven by an electric motor whips cream, shreds vegetables, mashes potatoes and does eight other similar varieties of work.

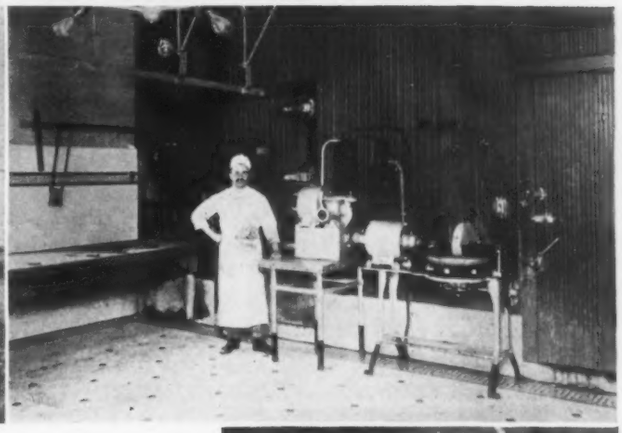
In the tailor shop two sewing tables of seven machines each and nine individual sewing machines are operated electrically, as are also a number of overhead fans.

A slow-speed, 3-hp. electric motor, through the medium of a big ironer in the post laundry, irons linen at the rate of 1000 pieces an hour. Other laundry machines operated by electricity are a large extractor, a marking machine and three glove shapers.

All of the elevators in the various buildings are operated electrically.

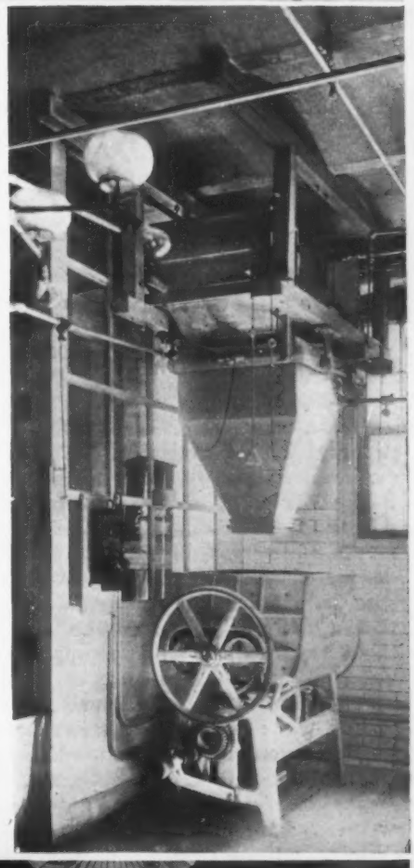
*Of the Society for Electrical Development, Inc.

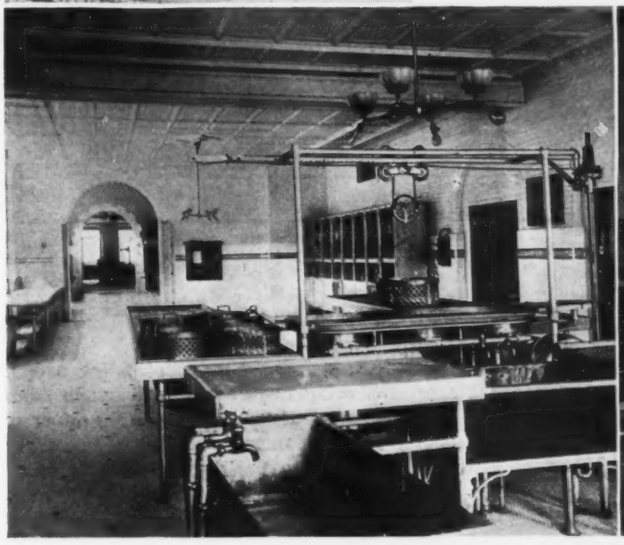




Electricity in the Army Kitchens at West Point

The preparation of food for the cadets, army officers and soldiers at the United States Military Academy at West Point is a task which necessitates cooking on a large scale with every attention to health and sanitation. Electricity here, as elsewhere, has solved the problem. All dough is mixed in the Academy kitchen by electrically driven machines, and the bread dough is automatically weighed and cut into 3-lb. loaves. Electric energy is employed to chop and work meats and to peel potatoes, several bushels at a time if necessary, while the task of washing dishes is eliminated by the use of an electrically operated dish-washing machine.





Searching for a Reason for Eye Fatigue

An Experimental Analysis of the Density of Radiant Energy as It Passes Through the Different Media of the Eye

BY M. LUCKIESH

It has been taken more or less for granted that the eyes tire under artificial light because the media through which the beam of light passes—the cornea, the aqueous humor, the lens and the vitreous humor—absorb a portion of the energy. This energy, it has been suggested, is transformed into heat, which in turn irritates the eye and causes fatigue. In an earlier contribution ("Electrical World," Oct. 25, 1913) the author of the present article summarized the results of certain quantitative experiments which indicated that the different media of the eye varied as to the amount of energy they absorbed. In this article Mr. Luckiesh presents the results of further experimental investigations and shows how the density of energy varies within the eye. No attempt is made in either article to determine the answer to the question of the final cause for eye fatigue.

IN an earlier article the writer gave quantitative data regarding the absorption of radiant energy (visible and infra-red) in the eye media.[1] These were obtained by using as a basis for computation the results of Aschkinass, who found that the eye media transmitted visible and infra-red rays in quite the same manner as pure water transmitted them. The ultra-violet rays are so insignificant from the standpoint of the possible "energy-effect" considered here that they are of no interest in these computations. The object has been to determine the relative magnitude of the amounts of energy absorbed by the various eye media as beams of light from sources at various temperatures passed through them. Many have taken for granted that eye fatigue is due to the absorption of energy without experimental data to support such a conclusion. It seems possible to determine experimentally the effect of energy absorption by surrounding an ordinary incandescent electric lamp with a water bath (or other solution transparent to visible rays but practically opaque to infra-red rays) and ascertaining whether or not the eyes are fatigued as much when used under this "low-energy" illumination as under the illumination containing all the original energy unaltered in wave-length. However, eye fatigue is an effect so vague that it always has been difficult to draw definite conclusions. Therefore it has appeared of interest to present as many data as possible before attempting experimental work involving such difficulties.

While preparing the earlier article the question of energy density in various parts of the path of the eye was considered, but no extensive computations were made. This question was brought forward several times subsequently, so that it seemed of interest to consider the energy density under certain conditions. These data should be of interest from the standpoint of the production of cataract. William Crookes[2] and his colleagues, composing a committee for the consideration of glassblowers' cataract, concluded that cataract is due to the absorption of long-wave energy rather than to a destructive effect of ultra-violet rays. This conclusion was based chiefly upon results of spectro-photographic tests of the radiation emitted by molten glass. The writer has photographed the spectrum emitted by molten glass and does not consider that there is present a dangerous amount of ultra-violent radiation. Contrary to these conclusions, Schanz and Stockhausen[3] decided that the radiation from molten glass is rich in rays of short wave-length. The apparent inconsistency is perhaps due to the difficulty in expressing the results because of the lack of agreement regarding the degree of destructibility of the ultra-violet rays of various wave-lengths that are transmitted by the cornea.

Recently Burge,[4] working in the Nela Research Laboratory, found that the radiation from a quartz mercury arc by itself "does not coagulate the protein of the normal lens (fresh lenses from pigs' eyes were used) or of the vitreous and aqueous humors, and hence does not affect the transparency of these structures after a continuous exposure of 100 hours." He found, however, that "the lens protein can be modified by solutions of

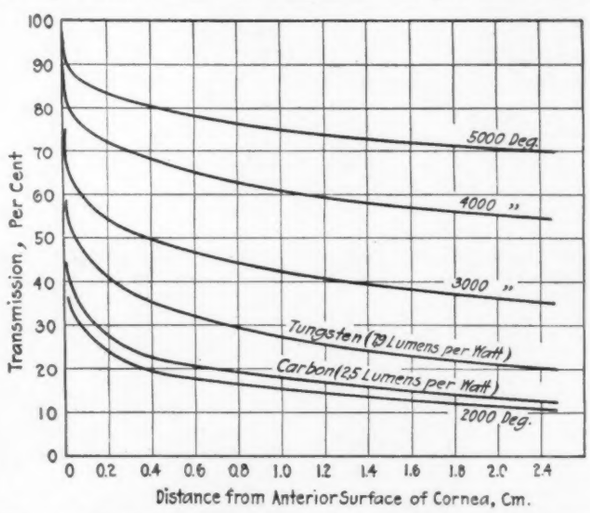


FIG. 1—TRANSMISSION OF VARIOUS DEPTHS OF THE EYE FOR THE RADIATION FROM DIFFERENT SOURCES

[1] "Radiant Energy and the Eye," by M. Luckiesh, ELECTRICAL WORLD, Oct. 25, 1913.

[2] *Trans. Royal Society*, A, 214, p. 1.

[3] *Graefe. Archiv f. Ophthal.*, 1910, 73, p. 553.

[4] *Amer. Journal Phys.*, 34, No. 1, December, 1914.

calcium chloride, magnesium chloride, sodium silicate or dextrose (too weak of themselves to affect the transparency of the lens), so that ultra-violet radiation can precipitate the modified lens protein and hence produce opacity of the lens." The effective region in the case of modification by calcium chloride is from 0.265μ to 0.300μ, the most effective region being around 0.265μ.

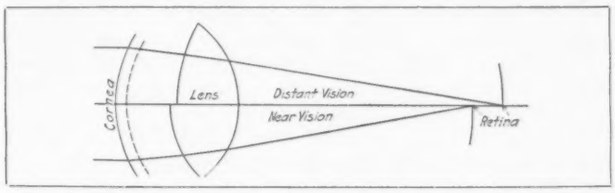


FIG. 2—PATH OF LIGHT IN THE EYE (SMALL OBJECT)

It is very doubtful that any appreciable amount of energy of the foregoing wave-lengths can reach the lens of the living eye because the cornea is practically opaque to rays of shorter wave-length than 0.300μ.

Analyses of senile cataractous human lenses by Dr. Burge "show that calcium, magnesium, and, in lenses from India, silicates, are greatly increased in this type of cataract." This led him to believe that the accumulation of these substances modifies the lens protein in such a way that certain ultra-violet rays can precipitate the protein, thereby producing cataract. Further experiments led him to conclude that long-wave energy (visible and infra-red) cannot coagulate either the modified or unmodified lens protein, provided that the coagulation due to excessive heat be excluded.

Notwithstanding the foregoing lack of agreement, it is of interest to consider, approximately at least, the energy density in the useful beam of radiation as it passes through the eye media. Utilizing the data in the writer's earlier article and some additional data, the transmission of various depths of the eye (measured from the anterior surface of the cornea) is readily obtained. The transmission curves for radiation from a black body at various temperatures and from a carbon and a tungsten lamp are shown in Fig. 1. Neglecting atmospheric absorption, which will be discussed later, the radiation from the sun can be assumed to be similar to that of a black body at 5000 deg. C. absolute. In order to obtain an idea of the energy density in various parts of a beam of light passing through the eye, it is necessary to determine the path of the beam. Obviously, the path of the useful beam is slightly different as the eye is accommodated for near or distant vision. Data regarding the refractive indices, thicknesses and curvatures of the various surfaces of the eye media as determined by Helmholtz were used. Only the beam that enters the pupillary aperture (in this case assumed to be 5.8 mm. in diameter) was considered. Computations give the paths for near and distant vision for a small object as shown in Fig. 2. The cross-section is considered circular as determined by the pupillary aperture. An image 0.01 mm. in diameter upon the retina would normally be formed by a circular disk 10 mm. in diameter viewed at a distance of about 15.5 meters. The refraction from the cornea into the aqueous humor is disregarded owing to the very small difference between their refractive indices; that is, for the purpose of computation the aqueous humor is considered as extending to the anterior surface of the cornea. The thickness of the cornea is shown to scale by the dashed line drawn parallel to its anterior surface. The eye becomes shorter and the lens thicker when accommodated for near vision.

The mean energy density in various vertical layers of the eye media under the above conditions is shown in Fig. 3. Curve *A* represents the relative energy density in various parts of the beam if there were no absorption by the eye media. If the small disk be diffusely and totally reflecting and be illuminated by radiation from a black body at 5000 deg. absolute, the mean energy density in various parts of the path of the beam is represented by curve *B*, after allowing for absorption. Curve *C* represents the conditions when the illuminant is a tungsten lamp operating at 7.9 lumens per watt. It is seen, as might be expected, that the mean energy density becomes relatively high near the retina. There is quite a uniform mean energy density, however, for more than half of the distance of the path in the eye. This is due to the fact that the absorption of energy in the eye media practically overcomes the concentrating effect of refraction. In the case of curve *C* this absorption more than overcomes any concentrating action. In order to compare curves *B* and *C* on a basis of mean energy density per lumen, the ordinates of *C* must be multiplied by a factor approximately equal to thirty. In other words, the energy density would be about the same for a beam of tungsten radiation (7.9 lumens per watt) containing one unit of light flux as for a beam of radiation from a black body at 5000 deg. absolute containing about thirty units of light flux. The energy-density curves are practically the same for near vision as for distant vision, and hence they have not been plotted.

Before discussing the foregoing further, it is of interest to consider the other extreme case—namely, when the object subtends a large angle. The limiting visual field subtends approximately a solid angle of 120 deg. The useful beam of radiation included within a solid angle of 120 deg. at the eye is shown by the full lines in Fig. 4, when the eye is accommodated for reasonably near vision. If the object that is being viewed be illuminated with the same density of radiation of the same spectral character as the object considered in Fig. 2, it is obvious that the brightness of the retinal image will be the same and a much greater amount of energy will pass through the pupillary aperture. In other words, the energy density at the retina will be the same

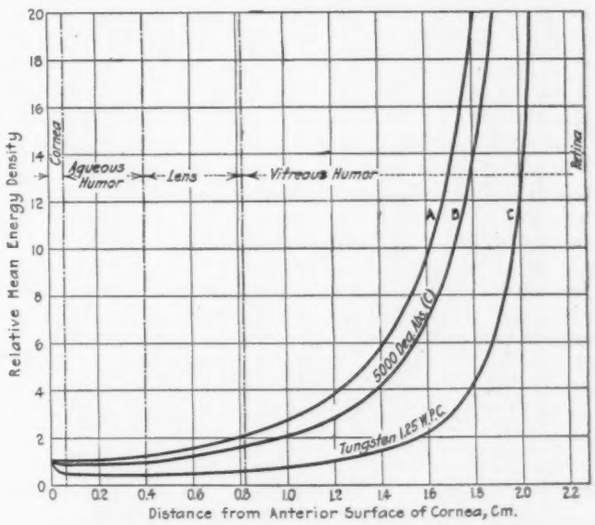


FIG. 3—ENERGY DENSITY IN THE USEFUL BEAMS OF LIGHT FROM A SMALL SOURCE (DISTANT VISION)

in the two cases, but the energy density in the lens and anterior section of the eye will be many times greater in the case of the extended source. The ratio of the energy densities in the plane occupied by the pupillary aperture will be approximately equal to the ratio of the solid angles subtended by the sources. In the two cases considered, when the brightnesses of the retinal images

are equal, the energy density in the pupillary plane for the case of the extended source is several million times greater than in the case of the small source. This is shown diagrammatically in Fig. 5 for equal energy densities at the retina—that is, for equal brightnesses of the retinal images. Curve *D* represents the condition

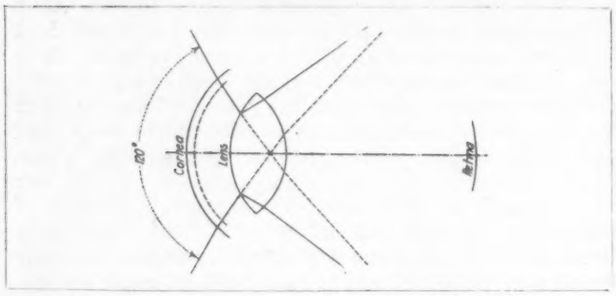


FIG. 4—PATH OF LIGHT IN THE EYE (EXTENDED OBJECT)

for the extended source and curve *E* for the small source.

The foregoing conditions are of importance in many cases of vision if eye fatigue or cataract is to be attributed to the absorption of energy. For instance, a small area of molten glass or metal may appear quite harmless. A larger area of equal brightness should appear equally harmless, but, as is evident from the foregoing, the actual energy density in various parts of the beam would be far different in the two cases. In the case of a large area the energy density in the lens would be many times greater than in the case of the small area. In ordinary vision there are many cases of extended areas of comparatively high brightness, such as a snow field, a desert, the sky, the walls of a room, and pavements.

It is of interest to consider the possible effect of sunlight (radiation approximately like that presented for a black body at 5000 deg. absolute), but in doing so allowance must be made for the absorption of radiant energy by the water vapor in the atmosphere. It has been observed that water vapor is more transparent to the sun's radiation than is water in the liquid state. Assuming that the absorption of the water vapor existing in the atmosphere is equivalent to a layer of the liquid 1.5 cm. in thickness, and with due consideration of the relative luminous efficiencies of a black body at the apparent temperature of the sun and of the tungsten lamp, it is found that approximately a hundred times as much energy is absorbed by the eye per lumen of tungsten light as per lumen of sunlight. But it is not uncommon to find sunlight intensities far greater than a hundred times that encountered with artificial light under working conditions. In fact, the ratio of actual working intensities is often greater than 1000 to 1. This indicates that eye fatigue and cataract should be quite noticeable under natural lighting conditions if they can be attributed to an energy effect. In fact, cataract is quite prevalent in India, but in this case, according to the work of Dr. Burge, the cause might be traced to an accumulation in the liquids of the body of something which so modifies the lens protein that energy of certain short wave-lengths can precipitate it, thereby causing opacity. If the energy effect is to be taken seriously as a cause of eye fatigue, the reflecting power of the objects ordinarily encountered in the field of vision should be considered. W. W. Coblentz[5] gives some interesting data on the diffuse reflecting power of various substances for radiation of various wave-lengths in the visible and infra-red regions. It would seem that those who advocate the theory that eye strain is due to the absorption of energy by the eye media would also direct attention to the advisability of using wall coverings and other surroundings which absorb the near infra-red rays. For these adherents to the "energy theory" the ideal surface for use with light sources of low luminous efficiency would be one that reflects the visible rays and absorbs the infra-red radiation. Such a surface would not be one of the popular "warm" colors, such as yellow and buff, in common use. Of course, there would be a re-radiation of energy which, according to Coblentz, would consist chiefly of rays of wave-lengths 8μ to 9μ for bodies at room temperature. The eye media are quite opaque to these rays.

To summarize, it is shown that when viewing luminous objects of small area (subtending a small solid angle) there is no serious concentration of energy in the eye media until the retina is approached. However, when viewing extended objects (large solid angle) there is a relatively much greater energy density in the lens and anterior parts of the eye than in the posterior portions. When the retinal images are of the same brightness, there will be a much greater energy density in the lens when viewing an object subtending a large solid angle than when the object subtends a small angle if the spectral character of the illuminant and the intensity of the illumination are the same. This indicates that large sources of a relatively low visual brightness might be effective in forming cataract or causing eye fatigue if the "absorption of energy theory" is correct. In fact, if the deterioration of the lens is due to ultra-violet rays, the latter might be present in such small amounts as to appear harmless, but when it is recalled that the energy density in the lens is very high when viewing extended objects, such as the sky, pavements, large surfaces of molten glass, metal, etc., it appears to be possible that the ultra-violet rays might be present in sufficient amount to do damage. From this standpoint sunlight, owing to the greater intensities encountered, appears to be probably as effective in producing cataract and eye fatigue as ordinary artificial illuminants, even after allowing for the higher luminous efficiency of the former and the absorption of energy by the water vapor present in the atmosphere.

It is not claimed that the data in this article and the previous one settle the question of the influence of energy absorption in the eye media. However, these articles contain a review of the subject from standpoints worthy of consideration. The object has been to show in what relative quantities the energy is absorbed in the various parts of the eye and also the energy density

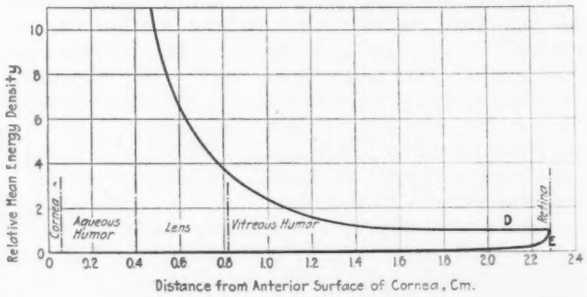


FIG. 5—ENERGY DENSITY IN THE USEFUL BEAMS OF LIGHT FROM SOURCES SUBTENDING LARGE (D) AND SMALL (E) SOLID ANGLES

in the path of the useful beam of radiation in order that those interested in eye fatigue and cataract might have these quantitative data available.

The writer takes pleasure in acknowledging the assistance of Mr. H. McMullan in making some of the computations and in the preparation of the drawings.

[5] *Journal Franklin Inst.*, Vol. 174, p. 564.

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Ways of Hunting Trouble on Distribution Systems

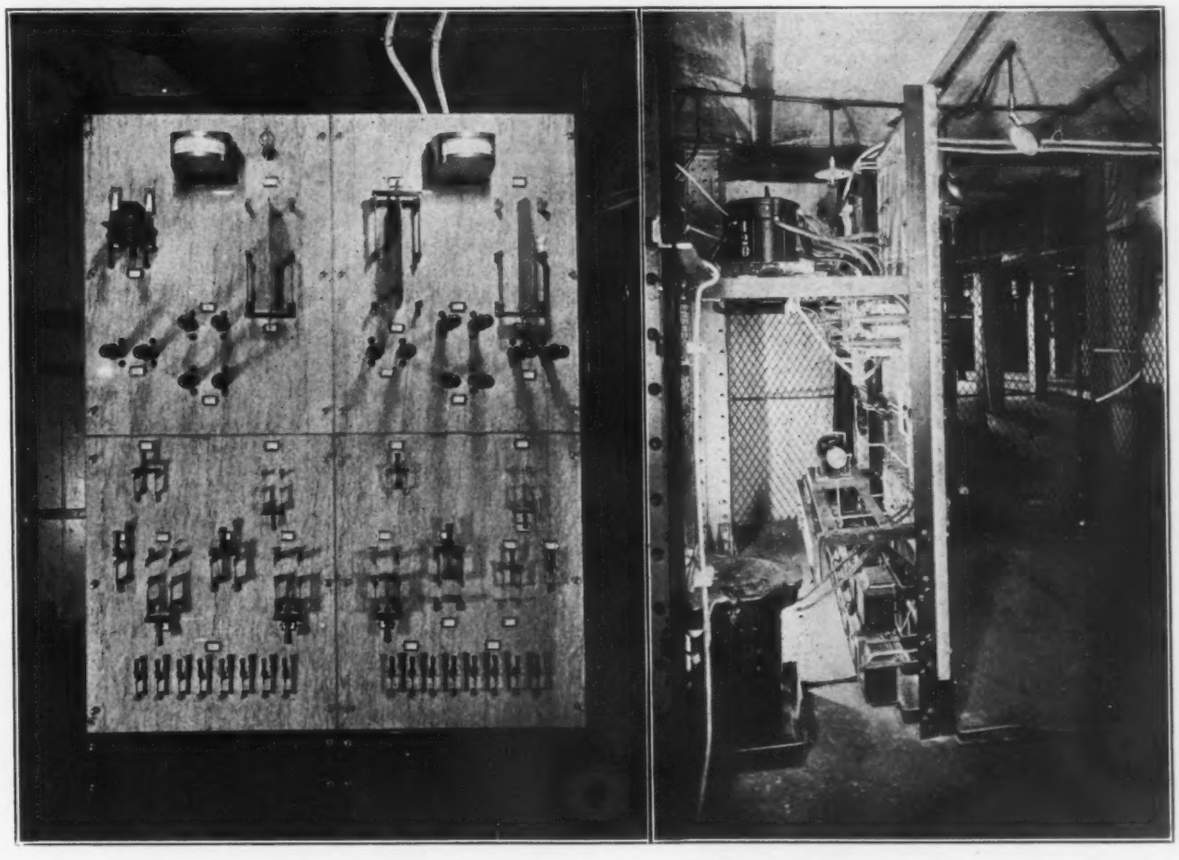
How an Exploring Coil with a Properly Interrupted Current Is Used in Order to Diagnose and Locate Faults on Overhead and Underground Lines—Method Employed by Boston Edison Company

METHODS for the detection of faults on central-station distribution systems, some very crude and others fairly effective, are used by the various central-station companies in this country. One of the largest companies that have given special attention to this problem is the Edison Electric Illuminating Company of Boston, Mass., now operating a distribution system covering an area of about 700 square miles in the streets and suburban district surrounding the Massachusetts capital. For many years this company has successfully used an interrupted-current and exploring-coil method to locate cable faults.

In brief, this method has consisted of applying a current interrupted in the past by hand but now by motor-driven equipment to a circuit composed of the faulty conductor and ground or of two defective conductors, and applying a small exploring coil to the sheath at intervals along the route. A telephone receiver is connected to the exploring coil so that at each make and break when an induced current flows in the exploring coil the difference in tone on either side of the fault enables the trouble to be located with great accuracy. The apparatus used by the company for this work has undergone an extended development during the past six years, and it now has reached a stage of perfection which permits it to be used by the ordinary troubleman without technical training. The company's practice in line trouble hunting has been developed by James A. Vahey, general inspector, maintenance of lines, of the Boston company.

The Equipment Used

The original apparatus used in the maintenance of lines department consisted of several lighting transformers, with the low-tension coils in series with each other and connected with the fault circuit. The rating of the outfit was 60 kw., with a maximum available pressure of 1300 volts. From 8 amp. to 10 amp. of sixty-cycle current was sent out over the faulty conductor and interrupted an agreed number of times per minute, en-



FIGS. 1 AND 2—SWITCHBOARD OF FAULT-ANALYZING SET IN L STREET STATION OF BOSTON EDISON COMPANY, AND REAR VIEW, SHOWING SMALL TRANSFORMERS AND INTERRUPTER

abling the trouble hunter to pick up a well-defined signal with the exploring coil in manholes. This equipment became inadequate to handle troubles on the cable system when the pressure was raised to 6900 volts and later to 13,800 volts on certain lines. The present equipment, therefore, grew out of difficulties in locating faults on a cable 10 miles long, and on account of its success

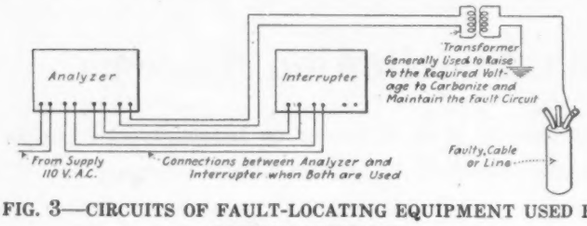

Analyzer
Interrupter
Transformer Generally Used to Raise to the Required Voltage to Carbonize and Maintain the Fault Circuit
From Supply 110 V. A.C.
Connections between Analyzer and Interrupter when Both are Used
Faulty Cable or Line

FIG. 3—CIRCUITS OF FAULT-LOCATING EQUIPMENT USED BY BOSTON COMPANY

three permanent sets are now installed respectively at the L Street generating station and the Zeigler and Scotia Street substations of the company. Several other central stations in New England are also using the portable apparatus shown in the accompanying illustrations.

The new testing equipment is of 7.5 kw. rating, with pressures available from 115 volts to 6900 volts, or one-half the maximum voltage of the Boston system. These pressures are obtained by different combinations of connections when using standard lighting transformers with appropriate switches permanently wired to a switchboard inside a station for the analysis of troubles on lines whose terminals may be temporarily connected to the test panel. Varying amounts of current can be obtained in the fault circuit by connecting loading coils of certain constant values singly or in multiple, at this switchboard or on the portable apparatus. The signaling portion of the equipment can be adapted to any existing break-down apparatus, and consists of a specially designed motor-driven interrupter impressing waves with a frequency of about 600 cycles maximum on the tested line, when used on a sixty-cycle system. The transformers, loading coils, switches, etc., are designated as the analyzer. Both analyzer and interrupter are built in portable styles differing in capacity but essentially the same in principle as the permanent sets.

The waves produced by the interrupter are of a frequency to which the telephone receiver and the ear are most responsive. An interrupter current of 1 amp. easily can be heard in a commercial circuit carrying 200 amp. at sixty cycles. Either alternating current or direct current can be used in the interrupter, and a distinctly different tone is obtained with each. The apparatus is somewhat simpler when alternating current is used. The interrupter is of rugged construction, operates on the system voltage, and runs without attention, like any small motor-generator set. An ammeter is a useful but not a necessary addition to the testing outfit, and a pilot lamp of 16 cp. serves to indicate the conditions on the tested line. A transformer is generally placed between the apparatus and the line under test to protect the supply circuit.

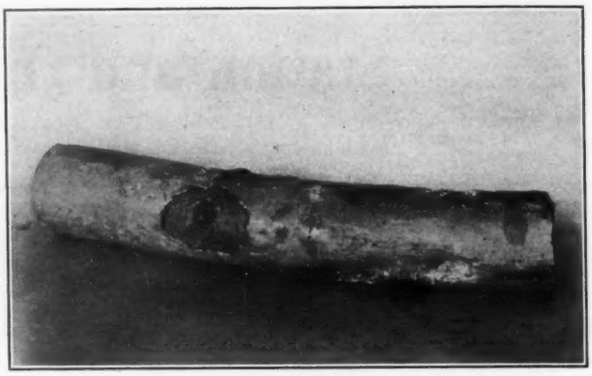


FIG. 5—FAULT IN 13,800-VOLT CABLE SUBMERGED IN WATER FOUND BY FAULT-LOCATING EQUIPMENT

The Portable Apparatus

To locate faults in cables leading from suburban stations, a portable testing set of about 4-kw. rating is used. This is carried in an automobile to the substation from which the faulty line radiates, and the set works as well as the larger equipment, except for the time lost in transporting and setting up the apparatus. For secondary networks and faults of very low resistance in isolated wires and cables a portable vibrating interrupter set, operated with two dry cells, is used. This gives a good signal and produces an audible sound in the exploring coil through a fault of 1000 ohms. It is employed in locating trouble on live circuits with pressures up to 250 volts, and the sound produced can be heard on a circuit carrying 50 amp. at sixty cycles.

The exploring coils illustrated are used to pick up the interrupter signal, the horseshoe-shaped or trans-

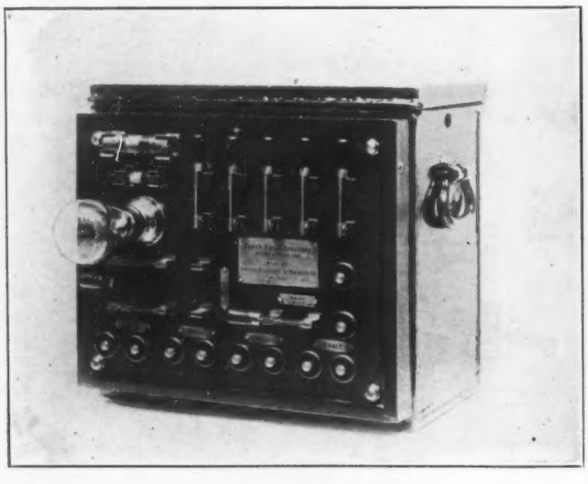


FIG. 4—FAULT ANALYZER USED BY BOSTON EDISON COMPANY

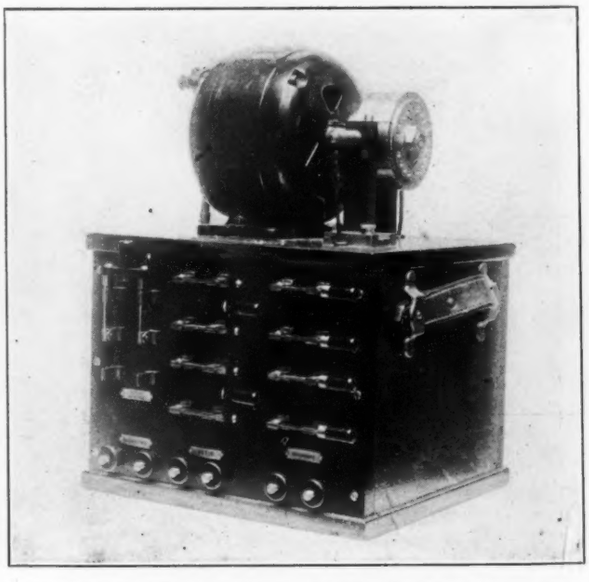


FIG. 6—PORTABLE TYPE OF INTERRUPTER USED BY BOSTON EDISON COMPANY

verse coil being employed on single-conductor or duplex cable and overhead lines, and the straight or longitudinal coil for multiple-conductor, three-phase cable. The triangle is used in picking up signals along the surface of the ground.

With the apparatus all the necessary variations in pressure and current required in testing central-station distribution and transmission lines can be attained with ease. Up to 4000 volts grounds on circuits which will operate grounded can be located alive without difficulty, and arcing, high resistance and swinging grounds may be made solid and located without interfering with the operation of the line. The use of this equipment by the Boston company on street-lighting circuits has shown that opens, grounds and short-circuits can be located with rapidity, say in one-half hour, compared with from two to three hours under former methods, and troubles on underground transmission lines can be found even on circuits 5 miles to 10 miles long inside of two hours, compared with all day when using the old methods. Without climbing poles or entering manholes, "opens" can be located on street-lighting circuits between two lamps. Also troubles in split-conductor circuits can be located by the use of the interrupter. Cables can be identified for tagging, and phases determined in customers' premises or outside. If desired, the apparatus can be used as an adjunct to Wheatstone-bridge and loop tests. The exploring coils are insulated for 10,000 volts. No outside connection with lines is required.

Carbonizing the Faults

The ordinary procedure in locating all faults except opens is to use the alternating current of the system to maintain a path across the burn-out, and to superpose on the circuit thus formed the signaling current. In open-circuit work the interrupter only is used in locating the break. Practice shows a great variation in the resistance of faults in high-tension cables. With a working pressure of 13,000 volts a cable may fail, and upon applying a pressure of 100 volts it may show practically a short-circuit through the fault. The next break in the same cable may necessitate a pressure of 5000 volts even to indicate the existence of the trouble. Hence the testing outfit must be capable of delivering energy at sufficient pressure to force current through the fault. It is also desirable to vary this pressure, since in the use of the exploring coil the best results are obtained with as low a test pressure as possible, which is also safer for the system and troubleman.

In lead-covered cables there is usually no metallic path at the fault. Almost invariably in high-tension cable breaks there is no metallic path between conductors or between conductor and sheath, a thick wad of paper or other insulation intervening. To obtain a closed circuit for testing, a path must be made across the insulation, and this is done by the application of pressure high enough to start a flow of current across the gap, the current value being just enough to burn or carbonize the insulating medium without destroying the material by combustion. When carbonized, 5 amp. or 10 amp. will flow through the fault at 100 volts or 200 volts, and the defect can easily be located at these pressures. In any case sufficient pressure and current are applied to the circuit to keep the pilot lamp on the analyzer dim, and in the actual location of the break the lowest possible voltage and current are used.

FIG. 7—TROUBLEMEN LISTENING WITH EXPLORING COILS IN CABLE TERMINAL HOUSE

The horseshoe coil is used on single-conductor street-circuit cable, and the longitudinal coil on 13,800-volt transmission cable.

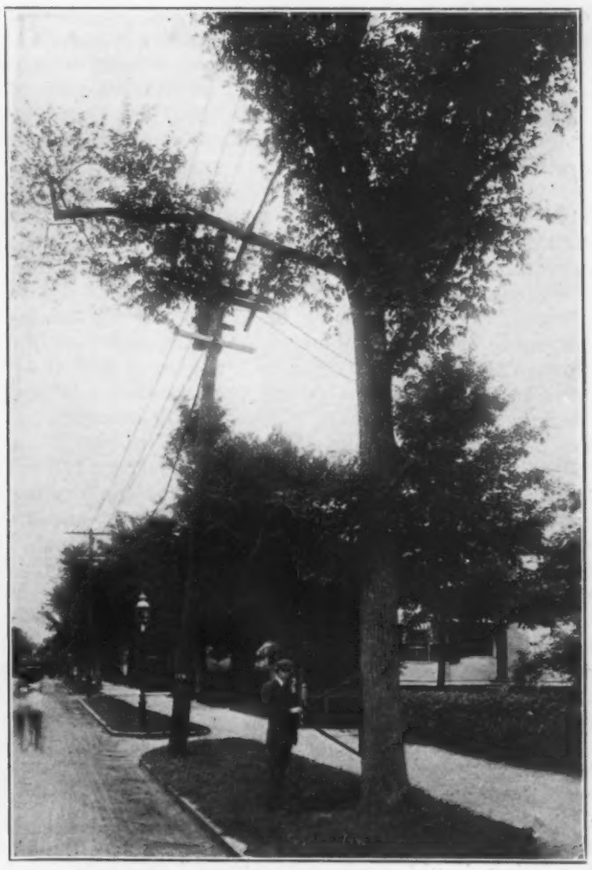


FIG. 8—TROUBLEMAN LISTENING FOR LEAKAGE DOWN TREE FROM INSULATOR

With the triangular coil at right angles to the line no sound is heard in receiver unless current leaks down the tree.

When the terminals of the analyzer and of the interrupter are properly connected and the faulty circuit is disconnected from the system, the troubleman connects the apparatus between line and ground or across conductors, as the case may be, and applies whatever pressure is deemed best. On circuits working at 2200 volts or over, 2200 volts is a good pressure to begin with. If the fault is solid or carbonizes at this pressure, the pilot lamp on the analyzer will show very dim or be out altogether when one of the load coils is placed in circuit. If this is the case, the operator puts in more load coils and notes whether the lamp continues to show dim. When the tester is satisfied with the carbonizing results, one load coil is left in circuit to hold the fault stable, preferably one of low rating, as too much current may burn up the path across the insulation and destroy the circuit made for the signaling current. In case of stubborn faults which will not carbonize, by throwing in a short-circuit switch the sudden application of full voltage will sometimes start a flow across the break; also the starting of the interrupter will sometimes help to accomplish this.

Ways of Analyzing Faults

If a conductor under test is clear, in no case will the pilot lamp burn dim, and with the line clear of fault the lamp will brighten with the circuit connected to the analyzer. In testing for grounds or short-circuits a brightening of the pilot lamp indicates that no fault exists at the pressure applied. A dimming indicates either leakage or fault current flowing in the circuit under test. If the leakage is simply distributed as on overhead lines, putting in more load coils causes the lamp to brighten, while a lower voltage shows the line clear. A certain critical voltage is required to make the leakage appreciable. If an ammeter is inserted in the supply leads and a load coil of say 5-amp. rating on short-circuit connected in circuit, more than 5 amp. may flow. If this is the case and the lamp still shows dim, it indicates that there is leakage and also charging current present in the circuit.

If the pilot lamp flickers rapidly when analyzing at 1100 volts or 2200 volts in a case where the fault takes considerable current at these pressures but cannot be carbonized, it indicates either that there is moisture at the break or that the fault is submerged. If not submerged, the fault can be dried out in half an hour and made solid. If submerged, the flickering will continue, although from 3 amp. to 5 amp. will flow at 1100 volts to 2200 volts, indicating that the break is under fresh water. If in salt water, the flickering is generally evident at 1100 volts or 2200 volts, but 3 amp. to 5 amp. flows with the application of from 110 volts to 220 volts. When the resistance of the fault remains constant and the same small amount of current flows at 220 volts after having made all possible combinations of voltage and current to carbonize, this also proves that the break is under fresh water. The 220-volt connection is generally best to locate this kind of a fault, and the pilot lamp dims slightly when this pressure is applied to the circuit if the trouble is under fresh water. The signal in such cases is not loud, but it is accurate.

Arcing in water or other liquid can be heard by listening with the exploring coil against the line at the test set. Arcing sounds are greatly magnified by listening with the exploring coil held against the load coils of the analyzer equipment. If a fault occurs in oil or other insulating liquid, such as compound, etc., in joints, the flickering takes place as in the case of water; but on account of the insulating qualities of the oil no current flows at low pressure.

More pressure is generally required to carbonize a break in a joint than in the cable itself. Thus, 2000 volts will almost always carbonize a fault in a 13,000-volt cable, but it generally requires about 4000 volts to start a flow of current for carbonizing a burn-out in a joint. This tells the trouble hunter what to expect, as a fault in the cable itself usually means pulling in a section of new cable, while a joint can nearly always be made over. In multiple-conductor cables there is sometimes a short-circuit but practically no ground except at a much higher pressure. This indicates a burn-out in a joint in a dry place, where the sleeve of the joint is blown wholly or partly away, or if there is both overhead and underground construction in the faulty circuit, it may be in a pothead at the cable terminal. In multiple-conductor cables faults under water may sometimes be made solid by using rather high pressure between conductors, thereby welding some of the strands of the faulty conductors together.

Sometimes with street-lighting circuits the lamp shows dim if there are lamps between the station and the fault only when a small load coil is used and it is impossible to get a circuit of very low resistance even with higher pressure. If the pilot lamp does not flicker, it indicates that the fault is solid and the resistance is due to the number of lamps between the station and the fault. Arcing at a fault will increase the pressure at the pilot lamp, and the current in the load coils will be abnormal. With magnetite street circuits the resistance of the lamps is about the same whether they are burning or not, so that when testing, if there are a number of lamps in series between the station and the fault, not much current will be taken from the load coils and the smaller coils must be used to obtain the proper dimming of the pilot lamp. In tungsten street circuits the reverse is true, the resistance being only about one-tenth as much when cold as when hot, so that it is fairly easy to obtain a flow of current in the circuit at low voltages if the fault resistance is low. All overhead lines, and also underground cables with street fixtures, transformers, etc., connected to them, will show some leakage when in normal condition. For tree trimming and the like the distribution of leakage can be traced by carefully going over a line with the exploring coil.

Locating Open Circuits

"Opens" in cable can be readily located between two manholes, and it makes no difference whether the receiver terminals are touched or not. In no case is it necessary or advisable for the tester to be personally grounded when touching the receiver terminals. The sound on an "open" can be followed in the same manner as a ground, listening at standpipes, etc., in a combination overhead and underground circuit. If there is no sound at a pipe leading from the conduit to the pole top, the tester listens at the top of the pipe, preferably at the line-wire side of the cable.

If there is a leak across the "open," such as may occur in the older type of street-circuit apparatus, where hood cut-outs, etc., are used, such "opens" are traced by the fact that while the sound is increased when near the "open" by touching one receiver terminal, a point further along the line is reached where the sound is still heard but it is impossible to increase it by making contact with either of the receiver terminals. This effect indicates that the "open" has been passed, and also that the "open" is shunted by a leak. Generally the sound can be increased up to about 400 ft. on the station side of the "open," while at the same distance beyond the break the sound cannot be increased. This will enable the trouble to be located usually within two lamps.

The next section of this article will take up the location of other faults and the methods used.

Some Problems of Furnace and Boiler Economy

Causes of Low Furnace and Boiler Efficiency, Interpretation of Operating Conditions, Results of Hand and Automatic Firing During Tests at St. Louis Water-Works

BY A. L. WESCOTT*

IT is well understood that the greatest opportunity for improvement in steam-plant economy lies in the boiler room. With a given equipment of steam prime movers, the limitations in economic performance are well understood and are readily attained and maintained. But in the processes of combustion in the furnace and heat absorption in the boiler many of the things which affect economy are obscure and not easily seen or understood by the operating engineer of ordinary competence.

In what follows some of the problems connected with boiler and furnace economy as observed by the writer during a year's connection with the engineering staff of the St. Louis water-works will be discussed. The mechanical equipment consists of one low-service and three high-service pumping outfits. The low-service station is several miles north of the city at the Chain of Rocks, where water from the Mississippi River is pumped into settling basins, filtered and treated, and made fit for consumption. One high-service pumping station is at the suburb of Baden, about 3 miles south of Chain of Rocks, and two others are at Bissell's Point, 4 miles further south. The four boiler plants in these four stations contain a total of about 7800 boiler-hp. In addition, the water-works department has charge of the mechanical equipment at the city sanitarium, including six boilers of a total capacity of 2100 boiler-hp. All of these boilers are of the horizontal water-tube type.

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The Hawley down-draft furnace is very popular in St. Louis and is probably the most economical and the most nearly smokeless hand-fired furnace that has been designed for Western bituminous coals. The pumping plants of the St. Louis water-works have, with one exception, been equipped with these down-draft furnaces. The accompanying sketch (Fig. 1) shows the principal features in the construction of this furnace. In one of the high-service pumping stations at Bissell's Point Roney stokers and chain grates have been used. The down-draft furnaces at the Chain of Rocks low-service station have also recently been replaced by chain grates. This form of mechanical stoker is in use at the city sanitarium and seems destined ultimately to replace all other forms of furnace in plants operated by the Water-Works Department of St. Louis.

Screened lump coal is burned in the down-draft furnaces, and the annual consumption amounts to nearly 60,000 tons, costing in the neighborhood of $100,000. It was believed that a substantial saving could be made in this large fuel bill if one mechanical engineer was employed to give all or most of his time to the problem. At each plant daily records were kept of coal burned and feed water pumped into the boilers. The weekly station reports showed boiler efficiencies of about 60 per cent. It was planned that improvement should be attempted by making a study of furnace conditions and losses, by educating the firemen to better methods of firing, and by the installation of such instruments and apparatus as were believed to be essential to enable the firemen to do their work more efficiently.

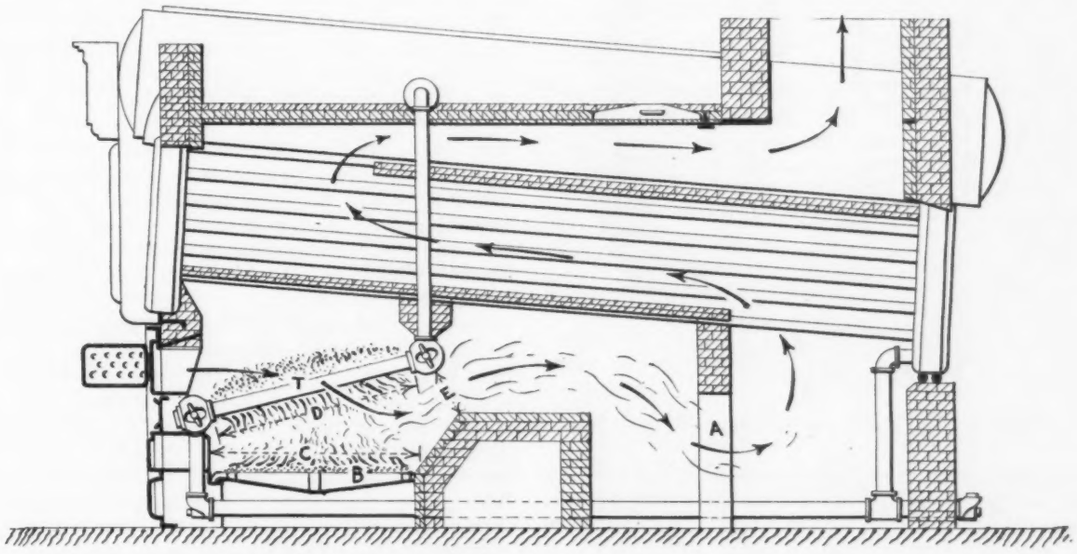


FIG. 1—HAND-FIRED WATER-TUBE BOILER EQUIPPED WITH DOWN-DRAFT FURNACE USED IN TESTS

The furnace consists of a double grate, one part above the other. The upper grate is a row of inclined water tubes, through which water circulates, forming part of the circulating system of the boiler. The lower grate consists of ordinary cast-iron grate bars, arranged as in a "straight-draft" furnace. Coal is fired on the upper grate. The draft passes from above downward, and from the ash pit upward through the lower grate. The lower grate is covered with incandescent coke that falls from the upper grate after the volatile gases have been distilled off. The volatile matter from the green coal passes downward, is mingled with an excess of highly heated air passing up through the lower fuel bed, and is burned in the combustion space at the rear of the bridge wall. This mingling of the volatile combustible gases with heated air at just the right place is very favorable to complete combustion without smoke. The arrow lines show the path of the gases. The combustion arch, shown as *A*, represents the construction recommended by the St. Louis smoke and boiler inspector in furnaces of this form. All of the furnaces in the water-works boiler plants in St. Louis have these arches, and it is believed that they aid materially in keeping down smoke. The distance *C* is 5.5 ft., *D* is 5 ft., and *E* 20 in. *T* is the top grate of the furnace of water tubes.

Steps in Study of Furnace Conditions

The first step in the study of furnace conditions and boiler economy was the installation of certain apparatus. A steam-flow meter was installed on one of the boilers at the Baden station, a CO_2 recorder was installed, and draft gages were placed on each boiler. With this equipment in place, one man with an assistant could take all data necessary in making a boiler test from which the efficiency of boiler and furnace could be determined. It was realized that if firemen were to be taught to use the dampers to control the draft, and thus control the steaming of the boiler, convenient means would have to be provided to do this from the firing floor. As originally installed, dampers were controlled from the rear of the boilers, an arrangement so inconvenient that it could not be expected that firemen would use it. One of the first things to do, therefore, was the construction of improved damper arrangements.

Given draft gages, one on each boiler, convenient means of regulating the dampers, steam-flow meter and CO_2 recorder, it remained to determine the setting of dampers for the best furnace efficiency. A series of boiler tests were undertaken with these purposes in view. They were really furnace tests, special study being made of combustion and the expectation being that improvement would be mainly through increased furnace economy. The observations made included weight of coal fired, evaporation (by steam-flow meter), percentage of CO_2 in the escaping flue gases, temperature of feed water, and draft readings. Samples of the coal and ash were taken so that the calorific value of the coal and the combustible lost in the ash could be found. It was planned to experiment with different intensities of

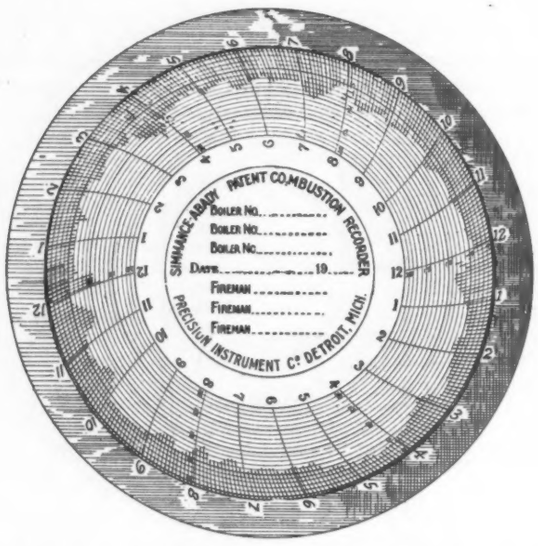


FIG. 2—CHART TAKEN FROM CO_2 RECORDER DURING TESTS

draft, thickness of fire, and methods of handling the fire, in order to determine those conditions giving the highest efficiency.

Causes of Low Furnace and Boiler Efficiency

It is the function of a steam boiler to absorb the sensible heat from the highly heated products of combustion that come in contact with its heating surfaces in passing from the furnace to the chimney. It is the function of the furnace to manufacture these hot gases by the process of combustion. It is helpful in our thinking about steam generation to keep these two things separate in our minds. Boiler efficiency, for instance, is promoted by keeping the heating surfaces clean, free from scale and soot deposits; by promoting rapid circulation of the water, so that steam bubbles are removed as rapidly as formed; by keeping all baffles tight so that the gases shall not be short-circuited past the heating surfaces, and by keeping the boiler setting tight so that cold air shall not leak in and mingle with the hot gases. Furnace efficiency is determined mainly by the efficiency of the process of combustion. A certain amount of air is required for the complete combustion of each pound of coal. If it were possible to have a perfect mixture of the fuel with the air, and at a sufficiently high temperature, the amount of air supplied would not need to exceed that which is theoretically necessary. But, practically, a considerable excess is necessary, as a perfect mixture is impossible. The largest single item of heat waste in the operation of a boiler is that due to the sensible heat in the escaping gases. This loss is nearly proportional, with a given temperature of flue gas, to the weight of air per pound of coal that passes through the furnace. The importance of keeping the air supply per pound of coal down to the amount needed for complete combustion will be clear from the foregoing remarks.

Causes of Excess Air

Excess air is caused by:

1. Fire of uneven thickness. If thinner in one place than elsewhere, an excessive flow of air takes place through the thin area.

2. Holes burn through, allowing excessive flow of air. Screened lump coal contains more or less fine stuff mixed with coarser lumps. The fine coal burns out first, leaving the coarser lumps with large spaces, through which air passes in excessive quantity. This is recognized in well-managed boiler plants, where the firemen are required to break up all lumps to a uniform small size. Large lumps should never be fired.

3. Dirty fire. Clinkers formed on the grate retard the flow of air at that point, so that the fuel above does not get its proper air supply.

4. Excessive draft. The strength of draft should be proportioned to the thickness of the fire and the fineness of the fuel. Thus, it is commonly understood by combustion engineers that the successful burning of slack or screenings requires a very strong draft, on account of the resistance to the flow of air offered by such a fuel bed. On the other hand, when the fire in a hand-fired furnace has burned thin, the demand for steam being light, the force of the draft should be reduced by partial closing of the damper. Under such conditions the uninstructed fireman is almost sure to keep the damper wide open, resulting in a great excess of air and consequent heat loss.

Uneven Thickness of Fire.—It was first observed in connection with the down-draft furnaces that the firemen habitually fired heaviest at the back end, heaping the coal much thicker than at the front end. The use of long bars or pokers resorted to occasionally to loosen up the fire is most effective at the front, so that the combustion was much more rapid there than at the back. Instructions were given to firemen to maintain an even thickness of fire.

Holes Burning in Fire.—It was found that coal passers did not break up the coal as small as they should. Orders were given to have this remedied. Then, by the occasional use of a rake and frequent firing of coal in small quantities where holes formed, a marked improvement in this regard was obtained.

Draft Regulation.—Furnace builders usually specify the amount of draft over the fire that they must have to deliver the required capacity. Thus, with chain grates, a draft of 0.25 in. of water over the fire is common. The draft over the fire is an indication of the density

of the fuel bed. The thicker the fire and the finer the fuel, the greater will be the "over the fire" draft, with a given intensity of draft at the boiler uptake. The amount of draft over the fire, therefore, will vary under best conditions with the thickness of fire, which in turn is governed by the rate of evaporation. But this observation alone does not give complete information as to the flow of air and gases through the furnace and boiler, and it is becoming the practice now in progressive plants to connect the draft gage to both the furnace and the flue between the boiler and damper, so that the draft at either point may be observed at will. The velocity of flow of gases through the boiler setting is indicated by the difference in the observed draft between these two points. The greater this velocity, the greater will be the difference in the draft. There is a certain draft difference for any rate of combustion which coincides with the best combustion conditions.

1. When the draft difference is too great and draft over the fire is too small, this would indicate that the fire is too thin, or that holes have burned through. The remedy is to make the fire thicker where too thin and to fill up holes.

2. When the draft difference is too small and "over the fire" draft too large, the fire is too thick, or dirty, offering too great a resistance to the flow of air. Then clean the fire or reduce its thickness.

3. When the difference of draft and the draft "over the fire" both are too great, there is too much draft. Remedy, partly close the damper.

4. When both drafts are too small, open the damper.

In making these studies we were greatly aided by the CO_2 recorder. This was connected to the boiler flue so as to get a sample of gas just leaving the boiler. Any operation affecting combustion was indicated by its effect upon the percentage of CO_2. A copy of the record made during one day is shown in Fig. 2. The curve of CO_2 percentage is seen to consist of a series of peaks and hollows. Whenever the fireman loosened up the fire by the use of a poker, or cleaned the fire, the record responded by recording an increase in the CO_2. During that part of the day when the demand for steam is greatest the average record is highest. At night less water is pumped and less steam is used, and it will be noted that the CO_2 record is not so good as during the daytime.

TABLE I—RESULTS OF SEVEN TESTS ON A BOILER WITH HAND FIRING

No.	Boiler-Hp.	Efficiency of Boiler, Grate and Furnace
1	218	51.7
2	205	56.9
3	258	59.6
4	266	59.3
5	212	61.3
6	271	58.2
7	232	61.8

In Fig. 3 a graphical log of one test is shown. Five-minute observations of the rate of evaporation, as indicated by the flow meter, are shown, together with draft-gage readings over the fire and in the uptake. It will be noted that the rate of evaporation varied greatly in very short periods of time. A study of the firing conditions shows the relation between firing operations and the rate of evaporation. Beginning the test with a clean fire, the evaporation was maintained at about the rating of the boiler for the first two or three hours, falling off during the last hour before cleaning the fire, at 12 o'clock. The fire was again cleaned at 4 o'clock, and a decline in the rate of evaporation was again noted during the last hour preceding the cleaning.

The results of seven tests on this boiler are shown in Table I, which gives the capacity generated and shows the efficiencies of the boiler grate and the furnace. During these tests various settings of the damper were experimented with. It was found that damper regula-

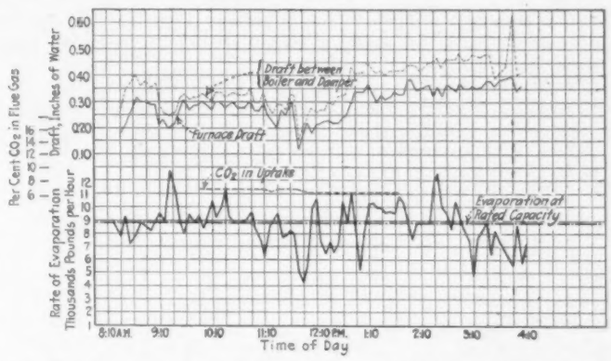


FIG. 3—EVAPORATION AND DRAFT READINGS DURING BOILER TEST

The data shown represent performance of a Heine-type boiler at the Baden station of the St. Louis water-works. The boiler was equipped with a hand-fired Hawley down-draft furnace. The heating surface of boiler was 2770 sq. ft. The area of upper grate was 46.6 sq. ft., and that of lower grate 50.3 sq. ft. Water evaporation was measured by flow meter in steam main from the boiler. The steam pressure was 150 lb. per square inch, and the temperature of combustion chambers as measured was about 1225 deg. Fahr.

tion, working with damper partially closed and therefore some draft in reserve, was generally an advantage, as indicated by an increase in the percentage of CO_2. When the fire was getting dirty, however, the full damper opening was necessary to maintain the required evaporation. Another difficulty in damper regulation was found in the burning off of the combustible on the lower grate previous to cleaning. If the draft is insufficient, considerable unburnt coke will be removed with the ash. It was found to be difficult, for this reason, to get firemen to follow instructions as to damper regulation. They were generally opposed to the dampers being partly closed for any reason. It was found practicable, however, to obtain a marked improvement in firing, in regard to holes burned in the fuel bed, level fire, and other things that affect the furnace efficiency.

Air Leakage.—One great source of loss in boilers with brick settings is air leakage through cracks that open up in the walls. The amount of this leakage may be roughly determined by comparing the percentage of CO_2 in the gases leaving the furnace with the gases leaving the boiler.

Let C = percentage of CO_2 in gas leaving the furnace.
C' = percentage of CO_2 in gas leaving the boiler setting.
A = ratio of volume of air leaking into the setting to the volume of gas leaving the furnace.

Then $A = (C - C') \div C'$.

The heat loss due to the sensible heat in the escaping gases is clearly increased in the proportion $(1 + A) : 1$.

Observations made on the boiler under test showed that there was from 50 to 100 per cent leakage. The setting was between fifteen and twenty years old. Many of the larger leaks were located and stopped up, thus materially decreasing the amount of leakage.

A number of tests were made to determine the advantage, if any, of the Roney stokers at the high-service station at Bissell's Point, reference to which has been previously made. Coal is handled by hand-shoveling

into tram cars, which are brought on tracks to the proper firing position in front of the boiler. It was the original intention to burn low-grade slack coal. This was found to make a good deal of trouble on account of clinkers, and resort was made to washed coal, at considerable increase in expense. A series of tests were made to study the working of these boilers with slack coal and with washed coal, special attention being given to damper regulation, clinker formation in the furnace, and comparative cost of evaporation with the two kinds of coal. Table II gives a summary of the results that were arrived at.

TABLE II—TESTS ON A BOILER WITH AUTOMATIC STOKER

(Test was made on Heine boiler, with superheater, and Roney stoker. Heating surface, 3550 sq. ft. Superheating surface, 1430 sq ft. Grate surface, 65.7 sq. ft.)

	Test Number				
	1	2	3	4	5
Kind of coal used	Slack	Slack	Washed	Washed	Washed
Steam-pressure gage	162.7	164.7	169.8	159.4	159.0
Furnace draft, inches water	0.228	0.254	0.168	0.25	0.20
Draft between boiler and damper, inches water	0.473	0.412	0.317	0.37	0.407
Temperature of steam, deg. Fahr	492	491.5	494	528	500
Temperature of flue gas, deg. Fahr	527	508	507	620	573
Boiler-hp. developed	408	367	371	387	386
Builder's rating	350	....	....	....	....
Percentage above rating	16.5	5.0	6.0	10.75	10.4
Efficiency boiler and furnace	57.2	67.4	69.8	62.0	62.5
Cost of coal per ton of 2000 lb. delivered	$1.14	$1.14	$1.76	$1.76	$1.76
Cost of evaporating 1000 lb. water from and at 212 deg.	$0.094	$0.090	$0.125	$0.122	$0.129

An inspection of Table II shows that, while the efficiency was higher with the washed coal, the cost of evaporation of a given amount of feed water was decidedly less with the slack coal. A comparison of efficiencies and draft-gage readings shows that the higher efficiencies were obtained with the lower draft. It was found that to maintain a good fuel bed over the entire grate some reduction of draft was necessary, and this more perfect covering of the grate with fuel was probably the main reason in the production of better economic results.

Difficulty was encountered at times when burning the slack on reduced draft on account of clinker formation on the grate bars and on the bridge wall. The latter was likely to interfere seriously with the operation of the dumping plates. Accumulations of slag on these plates sometimes caused serious trouble, even to putting the boiler out of service, with resulting interference with the pumping of water. These considerations make it difficult to get even the most intelligent firemen to follow up the idea of draft regulation in the case of these stokers.

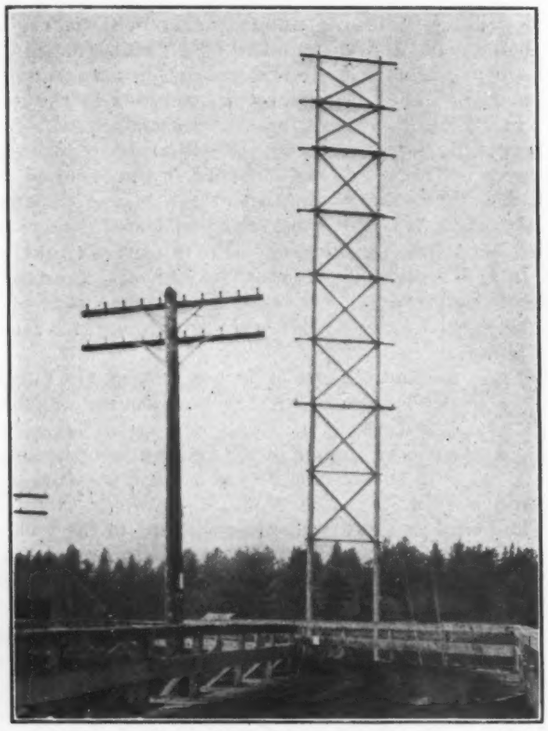


FIG. 1—ONE OF THE WOODEN TOWERS OF A 1611-FT. SPAN

WOODEN RIVER-CROSSING TOWERS

Details of Tower Construction to Support a 1611-Ft. Span of 5/16-In. Galvanized-Steel Conductors

Across the Lewis and Clark River, on the 25,000-volt, three-phase line between Astoria and Flavel, Ore., is a 1611-ft. span supported on 135-ft. wooden-pole towers. To construct a wooden tower of this height it was necessary to splice the poles used. The design of the towers is of the flexible type, consisting of two poles set parallel to each other and cross-braced with horizontal strips and diagonal struts. This type of construction was adopted because of the lack of space in which to erect four-pole A-frame designs. The towers are situated on tidelands which are below the high-water mark and protected by dikes. In order to provide substantial foundations each tower was set on 14-ft. by 28-ft. timber cribs buried 10 ft. below the surface of the ground. As 60-ft. clearance was required between high water and the lowest conductors, 5/16-in. Siemens-Martin galvanized-steel wire was used in the crossing span so that it could be drawn up fairly taut. Telephone wires of the same size and material as the electric-service conductors were strung between the towers 20 ft. below the latter. No. 10,749 Ohio Brass strain insulators were used to dead-

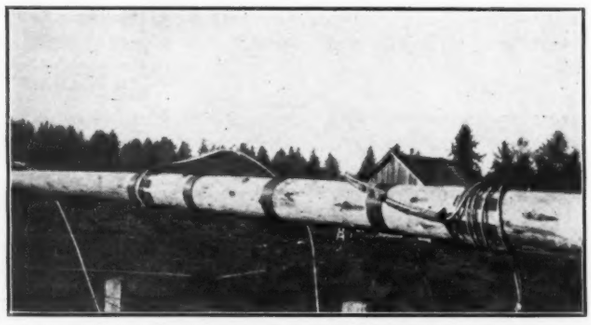


FIG. 2—SPLICED SECTION OF A 135-FT. POLE FOR RIVER-CROSSING TOWER

end the long-span conductors, from which wires lead down to the elevation of the standard line, which uses Thomas No. 2067 pin insulators fastened to the ends and centers of cross-arms spaced about 13 ft. 4 in. apart. No. 1009 Thomas insulators were used on the vertical runs of the telephone circuit.

Arrangement of Cross-Arms

The cross-arms on which the long-span power wires were dead-ended consisted of two 8-in., 11.25-lb. channels fastened back to back by spacing plates riveted to the flanges at the middle, ends and 3 ft. 4 in. each side of the middle. The end and middle plates, which are

10 ft. apart, also serve to hold eye-bolts fastened to the long-span dead-end insulators. The details of this cross-arm and insulator connections are shown in Fig. 3. The remaining cross-arms are made of wood. The double arms dead-ending the telephone line measure 6 in. by

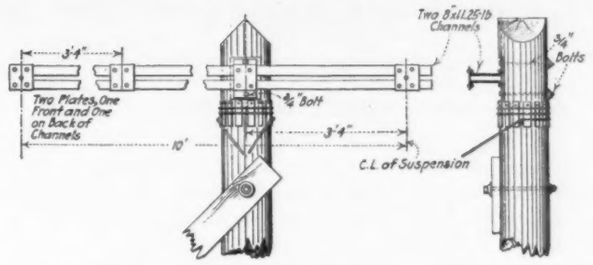


FIG. 3—ONE-HALF OF DEAD-END CROSS-ARM AT TOP OF RIVER-CROSSING TOWER

6 in., one being 21 ft. long and the other 15 ft. The longer arm serves as one of the supports of the vertical run on the 25,000-volt circuit. The other cross-arms measure 2 in. by 8 in. by 21 ft., and support only vertical runs and brace the tower. A general idea of the tower construction can be obtained from Fig. 1.

The towers are guyed by several 0.5-in. galvanized-steel guy wires. Side guys attached about 10 ft. below the pole tops and also 51 ft. above the ground hold each tower against stresses transverse to the line, while double cables attached to the poles near each dead-ending cross-arm offset the tension in the long spans. The head and back guys attached to the tower poles 51 ft. above the ground withstand the buckling action due to the vertical component of the stress in the main guys. The shorter guys are fastened to ordinary dead-men while the longer ones terminate in anchor cribs placed 100 ft. to 120 ft. from the base of the towers. Where the guys are wrapped around the poles steel plates are nailed to prevent the cables cutting into the wood. Three three-bolt clamps are used in making the cable loops of the longer guys and two three-bolt clamps in the others.

Each anchor crib dead-ending a pair of long guy wires consists of fourteen 12-in. logs 7 ft. long, built up in a pit which was afterward filled with rock. The anchor

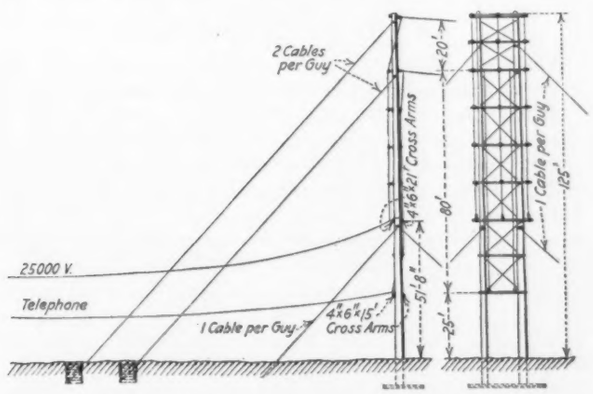


FIG. 4—METHOD OF CONNECTING LONG SPAN AND LOWER CONDUCTORS

rods, which were 1 in. in diameter and 12 ft. long, were run through the two lower logs and prevented from pulling out by nuts and washers fastened to the ends. The footings for each tower were made of 6-in. platforms, reinforced on the upper side with 6-in. by 8-in. by 28-ft. timbers running crosswise. To transmit the vertical stress in the poles to this grillage the lower end of each pole was mortised and fastened with drift bolts to 10-in. by 16-in. by 14-ft. timbers bearing on the footing. The poles were set a distance of 13 ft. 4 in. between bases.

Sixty-foot poles were employed in erecting the towers, and rather than haul them away after the towers were

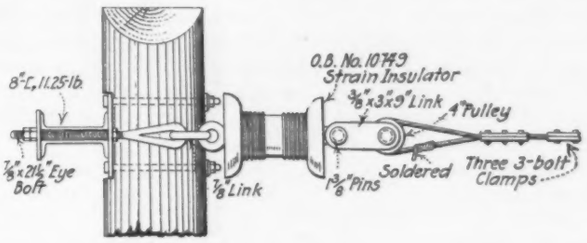


FIG. 5—METHOD OF DEAD-ENDING CONDUCTORS USED IN LONG SPAN

completed they were erected on the land side of the towers in place of the standard-length line poles, although the latter could have been used, as there was no

DATA ON TOWER CONSTRUCTION

No.	Description of Material	Dimensions
4	Fir poles	135 ft.
8	Pole-base timbers	10 in. by 16 in. by 14 ft.
30	Pole-base timbers	6 in. by 8 in. by 28 ft.
112	Pole-base timbers	6 in. by 6 in. by 14 ft.
2	Telephone cross-arms	6 in. by 6 in. by 15 ft.
2	Telephone cross-arms	6 in. by 6 in. by 21 ft.
6	Timbers for spacer blocks	4 in. by 8 in. by 10 ft.
8	Bracing cross-arms	2 in. by 8 in. by 21 ft.
24	Bracing pieces	2 in. by 8 in. by 20 ft.
8	Bracing pieces	2 in. by 8 in. by 18 ft.
10	Bracing pieces	2 in. by 8 in. by 15 ft.
112	Logs—cribbing for guys	12 in. by 7 ft.
2	Complete steel cross-arms	
	½-in. steel-guy cable, galvanized	4500 ft.
	7/16-in. S. M. steel transmission cable, galvanized	8100 ft.
16	Steel anchor rod, galvanized	¾ in. by 8 ft.
16	Steel anchor rod, galvanized	1 in. by 12 ft.
20	Washers, 1-in. hole, galvanized	4 in. by 4 in. by ¼ in.
16	Washers, 1¼-in. hole, galvanized	6 in. by 6 in. by ⅜ in.
4	Cross-arms	4 in. by 6 in. by 15 ft.
4	Cross-arms	4 in. by 6 in. by 21 ft.
10	Missing links	¾ in. dia.
20	Suspension links	3 in. by 9 in. by ¾ in.
20	Pins for above	1⅜ in. by 2½ in.
10	Pulleys	¾ in. by 4 in.
230	Shims	1/16 in. by 2 in. by 6 in.
32	Thimbles for ½-in. cable	
6	Eye-bolts	¾ in. by 21½ in.
4	Eye-bolts	¾ in. by 39½ in.
16	Drift bolts	¾ in. by 20 in.
64	Lag bolts	½ in. by 6 in.
10	Ohio Brass No. 10,749 insulators	
28	Thomas No. 1009	
42	Thomas No. 2067	
42	⅝-in. iron pin with 1¾-in. wood top	
28	Locust pins	1½ in. by 9 in.
42	Porcelain bases for Thomas No. 2067	
8	Machine bolts, all heavily galvanized and each furnished with one nut	⅝ in. by 10 in.
4		⅝ in. by 12 in.
20		⅝ in. by 16 in.
12		⅝ in. by 17 in.
8		⅝ in. by 24 in.
8		⅝ in. by 28 in.
8		⅝ in. by 30 in.
12		⅝ in. by 32 in.
8		⅝ in. by 36 in.
8		⅝ in. by 38 in.
200	½-in. galvanized, round, washers	
200	Three-bolt clamps	
12	Machine bolts	¾ in. by 26 in.

necessity of "grading up" the line owing to the construction of the towers. The line which these towers support is owned by the Pacific Power & Light Company, Portland, Ore., of which Mr. J. C. Martin is engineer.

A list of the material used in constructing these two towers is given in the accompanying table.

SERVING THREE-PHASE MOTOR LOADS

Use of Small Three-Phase Transformers for 11,000-Volt Distribution in Southern California

BY R. E. CUNNINGHAM*

The use of the three-phase transformer in large units for main-station and substation installations is now standard practice of operating companies, but the three-phase transformer in small units for distribution purposes has not come into general use. This may be accounted for by the fact that a three-phase transformer can be best used where a strictly motor-service or other balanced three-phase load is to be supplied.

A condition favorable to the three-phase transformer presents itself, however, on the 11,000-volt distribution systems of the Southern California Edison Company, which serves about 500 pumping plants for irrigation purposes, ranging in size from 10 hp. to 100 hp. each. In the past two or three single-phase transformers have been installed and in most cases within the pumping plant building. Such an arrangement involves the use of high-voltage cable in order to make a safe entrance to the building, with additional space called for inside the building, including concrete foundations. More recently the three-phase transformer designed for outdoor operation has been adopted for this service.

After a rather extended investigation, conjointly with the manufacturers, a transformer was decided upon having a Y-Y winding. Certain taps were desired on the high-tension side of the transformer, as well as double-voltage arrangement for the secondary side of the transformer, and the Y-Y windings allow these arrangements in the simplest manner. The arrangement of connections is shown in Fig. 2. The high-tension winding is ungrounded, with the neutral point of the low-tension winding grounded as a safety measure. The usual connection of the secondary coils is for a 460-volt service, although two secondary coils are provided on each leg of the transformer so that a 230-volt service can be obtained if desired. With a ground at the neutral point it is impossible to obtain a voltage in excess of 266 from any secondary line wire to ground. In most cases a few lamps are required around the pumping plant, and to furnish this service a tap is brought out from a winding on one leg of the transformer to supply 110 volts to the ground connection.

In Fig. 1 a typical pumping installation of 30-kw. rating is shown. The high-tension line is controlled by a pole-top air-break switch operated from a lever at the base of the pole. On the same mounting with the switch are fuses, consisting of 0.75-in. Bakelite tubes, 12 in. long, in the center of which the fuse wire is placed and the space filled with plaster of paris. With this arrangement the transformer is disconnected by the customer at times when the plant is not in operation, and unnecessary core losses are prevented. In case it becomes necessary to replace one of the high-tension fuses, the switch is opened by the troubleman before climbing the pole, so that he is not called upon to work on energized apparatus.

There is a saving to the operating company of from $50 to $75 on each installation through using the outdoor three-phase transformer rather than installing the single-phase transformers within the building. In addition to this, there is a saving to the customer, as he does not have to furnish the extra space and foundation for the transformers within the building. Even with the best arrangement of apparatus and the use of insulated high-voltage cables, it is impossible to make an inside installation as safe as the outdoor installation which is described above.

*Superintendent of distribution Southern California Edison Company.

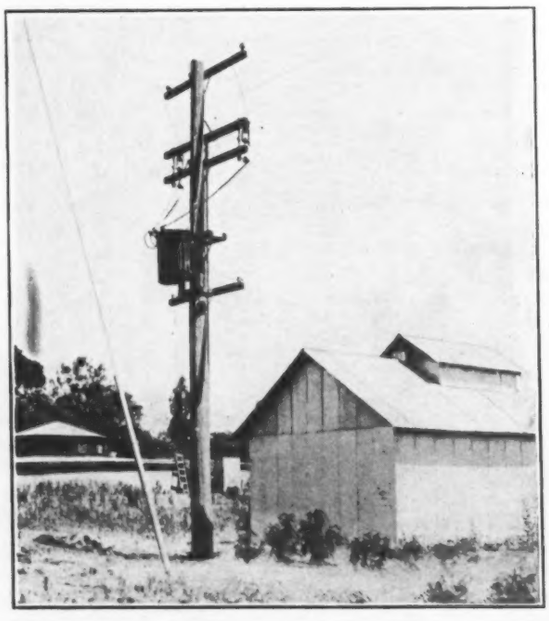


FIG. 1—A 30-KW. PUMPING INSTALLATION SHOWING THREE-PHASE TRANSFORMERS AND AIR-BREAK SWITCHES

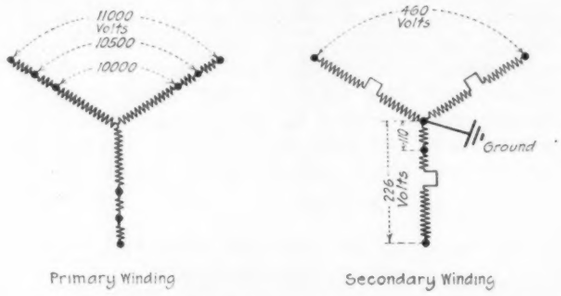


FIG. 2—WINDING CONNECTIONS AND VOLTAGE TAPS FOR THREE-PHASE DISTRIBUTING TRANSFORMER

Air Lift for Pumping Sand

While the efficiency of the air-lift pump is low, from 20 to 40 per cent, varying with the design and lift, its practical use for the last twenty-five years for deep-well pumping, together with its low upkeep, makes it compare favorably with other systems. In cases where sand is encountered this type of pumping has an advantage over other systems. In one case where water was obtained from wells 400 ft. deep, with the sand so fine as to form practically a fluid sand, no ordinary pump could handle the material, and filters soon became choked so as to cause constant failure of the supply. Three 14-in. holes were bored down 500 ft., and the water was raised 170 ft. with an air-lift pumping arrangement to an air-separating chamber with an air pressure of 94 lb. per square inch furnished by a Diesel-engine-driven compressor. About 14,000 gal. of the sand fluid are pumped per hour.

The successful operation of the air-lift pump depends upon the ratio of the depth of submersion (difference between total head and distance from discharge outlet and water level in well) to the total head. The efficiency increases as this ratio increases from about 0.55 to 0.85, and is equal to the water horsepower divided by the air horsepower of the compressor.

Operating Schemes

Two dollars will be paid for each item published giving ideas and data, new or simplified methods and experiences in solving troubles.

Value of Clean Bottles for Sampling Transformer Oil

The insulation strength of the oil in all transformers used on circuits operated above 6600 volts in the system of the Georgia Railway & Power Company, Atlanta, Ga., is tested once each month. When the oil shows an insulation strength lower than 40,000 volts it is filtered and tested until this strength is secured. It is well known that a small amount of moisture in oil greatly reduces the insulation strength, and inasmuch as a small sample must be taken for test, it has been found that extreme care must be exercised to secure and deliver the sample to the test room in the same state as that in which it is found in the transformer case. To make this possible a specially prepared 4-oz. sample bottle is furnished to station operators for delivering the monthly samples for test. These bottles are prepared by washing and rinsing in gasoline, then dried and the corks inserted. The cork and mouth of the bottle are then dipped in heated paraffin, which seals the bottle air-tight.

The value of this precaution was recently shown when a new attendant who did not believe in the value of the prepared bottle sampled the oil from a transformer and delivered it in a used bottle to the test room. The oil punctured at 32,000 volts and was ordered to be filtered. The attendant secured a new sample of the oil and delivered it in a specially prepared sample bottle, when it tested at 42,000 volts. This attendant now finds it easier to use the bottle than filter the oil.

About 0.04 per cent of water will reduce the insulation strength of oil to about 10,000 volts, the curve of decrease being very steep up to about 0.08 per cent, when the insulation strength decreases more slowly as water is added. The need in sampling oil of care such as that exercised in this case is therefore apparent, and the method used is a very simple one to eliminate errors in tests.

Emergency Baskets for Troublemen

To avoid delays when linemen are called to remedy trouble on the distribution system, the Greenfield (Mass.) Electric Light & Power Company maintains at its service headquarters seven baskets for emergency use only. These baskets are shown in the accompanying illustration and are 8 in. deep, 26 in. long and 24 in. wide. Each contains a hand line, fuse-compartment box, lineman's kit, strap, belt, pliers and other equipment used in quick repairs on 2300-volt and 13,000-volt lines. The fuse-compartment box is shown in the center of the display of the contents of the emergency basket in Fig. 1. The box is of tin 9 in. by 7 in. by 1.5 in. deep and divided into seven compartments containing fuses of from 2 amp. to 100 amp. so as to make it easy for the lineman to pick out the proper fuse material in the dark or in stormy weather.

FIG. 1—CONTENTS OF LINEMAN'S EMERGENCY BASKET

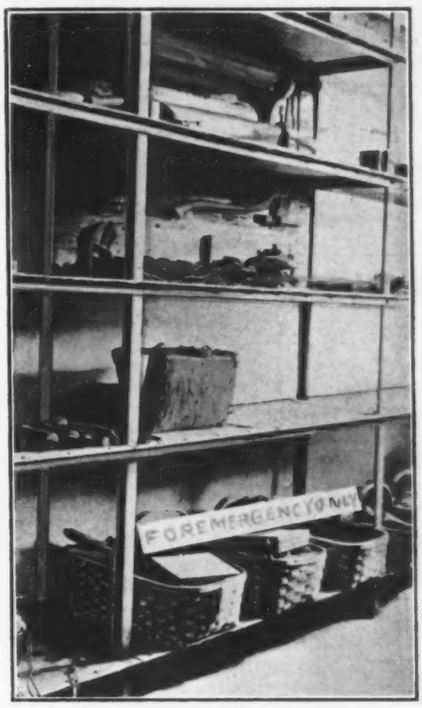


FIG. 2—LINEMEN'S BASKETS HELD AT SERVICE HEADQUARTERS FOR EMERGENCY CALLS

It has been found that much time is saved by this outfit in enabling a lineman to respond as soon as an emergency call is received.

How an Operating Engineer Can Prevent Accidents

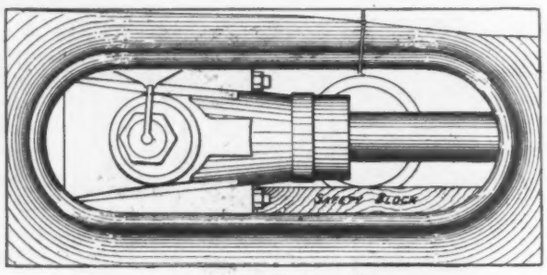
Although most of the accidents occurring in the engine room are of a minor nature, such as cuts and bruises, the possibility of serious injury to both persons and property is always present, and men operating engines should exercise great care at all times.

The first duty of an engineer, according to Mr. C. J. Smith in a recent safety bulletin issued by the Inland Steel Company of Indiana Harbor, Ind., is to examine his engine carefully when coming on duty to see that all parts are in first-class operating order, taking special pains to ascertain that all traps and drains are working properly. He should also check over carefully all the remarks made on the report of the engineer whom he relieves and make any necessary additional remarks before this report is sent to the master mechanic.

When starting an engine driving a generator operating in parallel with others, the generator should not be cut in at the board until the voltage is equalized. When shutting down, the generator should be disconnected from the buses before shutting the steam off the engine. An equalizing switch should not be pulled until the gen-

erator is disconnected at the board. Whenever an engine is shut down, it should be done by using the safety switch or safety valve. The speed of an engine should be taken every day in order to know that it is running at proper speed.

One should never attempt to push an engine off center by means of a bar, or to pull it off center by pulling on



BLOCK FOR ENGINES WHILE MAKING REPAIRS

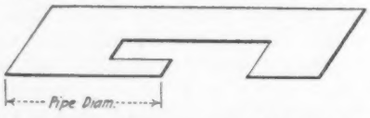
the belt when the steam pressure is on. In making adjustments or repairs to an engine, it is important to keep the clearances at the two ends of the piston as nearly alike as possible. If any difference be allowed, the clearance at the head end should be the greater. It is a good idea to provide marks on one end of the guide bars to show just what the clearances are. An operator should never carelessly stand in front of cylinder heads of engines; there are other and safer places to discuss and observe operating conditions.

A piston should never be taken out of a cylinder without making sure that the throttle and exhaust valves are shut tight and that the drains are wide open. The indicator cocks should also be tested to see that there is no pressure, for steam pipes should never be worked on under pressure. Under no circumstances should safety devices such as circuit-breakers, governors, engine stops, etc., be blocked or otherwise made ineffective. The governor should be frequently inspected to make sure that the stop collar is in such a position that steam is shut off when the balls drop near the lower limit. Also be sure that when the governor balls are at the upper limit the knock-off cams shut off all the steam and do not pass clear under the crab claw and get caught. Never put heavy grease in the oil pot of the governor and exercise care that no pieces of rubber gaskets or other materials get in the steam pipe where they may block the governor.

Operators should have at hand standard works on the operating principles of steam equipment and should study them. Equipment should not be tampered with or adjustments attempted without a thorough knowledge of what is being done.

Methods for Determining Diameters of Covered Pipes Accurately

Pipe diameters often vary from dimensions given in tables of commercial sizes. While these tables may be



GAGE TO MEASURE INSIDE DIAMETERS OF PIPES

used for ordinary purposes, they are not considered sufficiently accurate for use in computations involving the flow of steam or air in mains.

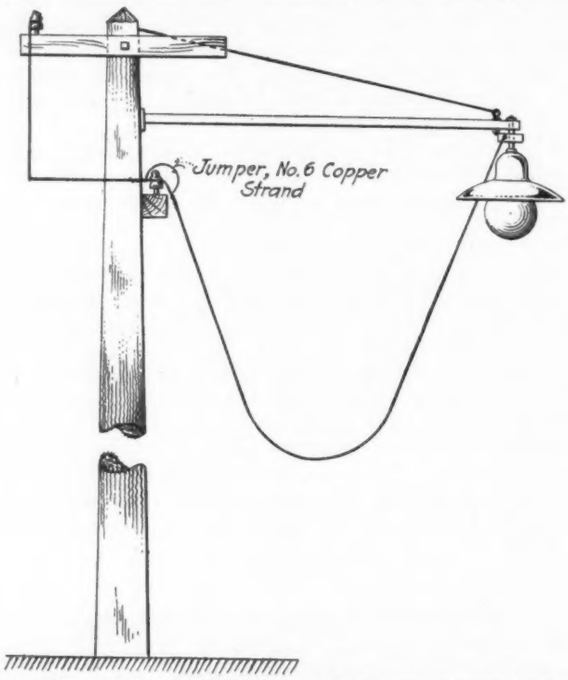
When it is desired to obtain the internal diameter of a pipe to which a flow meter is to be connected, it will be found convenient to use a piece of brass or other metal about 0.75 in. wide and 0.625 in. thick cut as shown in the accompanying diagram. That portion marked "pipe diameter" should be a little longer than the internal diameter of the pipe. When using this gage, file off the L-shaped projection until it just fits the pipe when inserted in the hole drilled for the nozzle plug of the flow meter. This will then be an accurate diameter.

A quick way to find the outside diameter of a covered pipe when the pipe covering cannot readily be removed is to drive one nail through the covering until it touches the pipe, and another directly opposite this point on the other side of the pipe. Measure the distance head to head of nails by calipers and deduct length of nails.

Jumpers Prevent Service Interruptions

At the place where lead wires to series street lamps leave the pole insulators the wires are subjected to constant bending. Eventually a break occurs at this point, causing a failure of the lamp circuit if no more serious trouble.

To prevent trouble from such breakages, completely, H. G. Gorr, superintendent of the lighting department of the Union Electric Company at Dubuque, Ia.,



JUMPER AT POLE INSULATOR OF SERIES STREET-LAMP CONDUCTOR

has placed jumpers of No. 6 stranded copper wire around insulators, as shown in the illustration. While these jumpers do not keep the line wires from breaking, they do keep broken lines from falling and in such cases make operation of the circuit continuous.

Troubles Cured by Shifting Brushes

When a continuous-current generator is operating and its full-field direction of rotation reversed, it will be impossible to build up its field with the reversed rotation unless either the field connections are reversed or the brushes are all shifted a distance equal to the angular distance between the centers of adjacent poles, or one pole pitch. Similarly, if the field connections are reversed, the machine will not generate full voltage

until either the direction of rotation of the armature has been reversed or the brushes have been given a shift of one pole pitch in whichever direction the length of the armature leads will permit. Finally, if the brush rocker arm has been shifted a pole pitch or less, it will be necessary either to reverse the rotation or to reverse the field connections before the machine will generate. If after making any of these changes on a compound-wound machine the voltage should decrease with an increase of load, it means that the series-field connections must be reversed in order that both field windings may act in the same direction.

A certain cement company purchased a second-hand generator which refused to operate after it had been installed. The engineer called in to investigate the trouble shifted the rocker arm one pole pitch and the machine built up at once. It seems that the machine was set up so that the armature revolved in the direction opposite to that it had operated in before. In another instance an inspector was called to prescribe for a machine that had operated all right for months and suddenly refused to generate. By shifting the brushes one pole pitch this machine was brought to life also. In this case an ambitious engine-room helper had shifted the rocker in order to clean the holders and had failed to restore it to the original position. A point worth remembering is that if failure of a generator to build up a voltage is a matter of incorrect relationship between direction or rotation, field connection and brush polarity, a shifting of the brushes one pole pitch will remedy matters.

Why Feed-Water Lines Should Be Sectionalized When Operating Economizers in Parallel

An accident which occurred aboard a ship emphasizes the need of paying careful attention to the operation of economizers in parallel and the sectionalizing of feed-water lines so that trouble in any economizer can be located before serious damage is caused. At the plant in question two groups of boilers were each fed by large economizers connected in parallel but utilizing heat from separate stacks. Each economizer consisted of two units equipped with by-passes and connected in series. Early one morning, according to a report in a recent issue of *Locomotive*, the attendant heard a rumbling noise in the hot section. He assumed that it was overheated and thoughtlessly attempted to open the by-pass valve around the colder section. As he did so a violent rupture of the valve and several tubes and headers occurred.

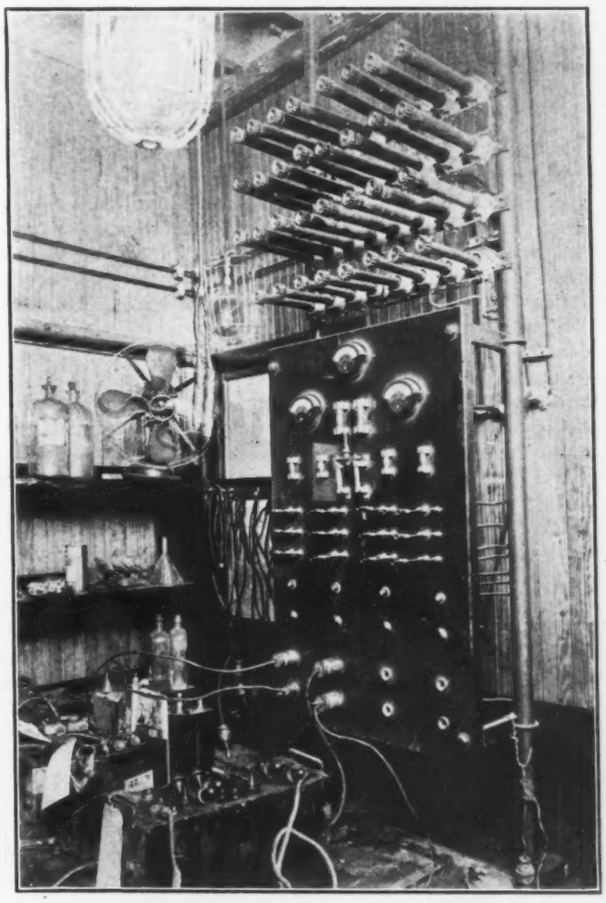
An investigation showed that the hot water had corroded the nut on the valve stem between the economizer and the main boiler feed line, allowing the gate wedge to drop and close the opening. As the failure evidently happened during the night prior to the accident, when the boilers were operating at light load, it was not noticed, feed water being supplied in sufficient quantity by the other economizer. With the water circulation cut off through one set of economizers, however, they soon began to overheat and generate steam, which probably accounted for the rumbling noise heard by the attendant. Therefore, when the relatively cold feed water was by-passed directly into the hot steam-bound section, water hammer occurred, causing the damage mentioned. This theory was further substantiated by the safety valves failing to open and by the gage hand being bent from striking the stop pin.

Had the main feed line been sectionalized instead of being used in common by all boilers, this trouble might have been averted since failure of an economizer to feed either section would have been indicated by a lowering of the water level in the respective boilers. Speeding up of the feed pumps to raise the water level would have opened the economizer relief valve and given warning that an obstruction was between the economizer and the boilers.

The practice of trying to cool off a cast-iron vessel suspected of being overheated by passing cold water through the hottest part of the structure should, of course, be condemned. The proper procedure in such a case would be to close the dampers, shutting off the hot gases and by-pass the heat up the chimney. After this is done the water supply should be shut off and the cause of trouble investigated. The corrosion of an iron valve is not an unusual occurrence, brass having been long ago recognized as superior to iron where hot water is handled.

Home-Made Charging Panel for Small Batteries

In order to be able to charge small storage batteries for ignition and lighting service conveniently, the Lowell (Mass.) Electric Light Corporation has constructed a special panel for use in the company's garage. The arrangement, as shown in the accompanying illustration, consists of a slate panel, 18 in. by 36 in. in size, mounted on a 1¼-in. pipe frame which serves as a conduit for the wiring leading to the rear of the panel. A set of series-parallel Ward Leonard resistance units designed to fit Edison sockets are mounted above the panel so that replacement can be made as quickly as with a lamp. The use of these units instead of a lamp bank cuts down the heating to the minimum. The panel is equipped with two miniature ammeters and one miniature voltmeter of Weston make, and it is so wired that



SMALL BATTERY-CHARGING PANEL WITH RESISTANCE UNITS AT TOP INSTEAD OF LAMP BANK

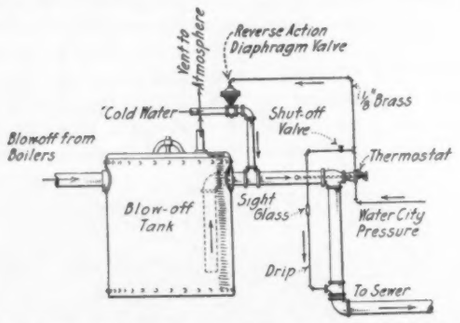
three sets of batteries can be charged at once, with the addition of a fourth undergoing discharge.

The circuits provide for three charging ranges—1 amp. to 6 amp., 6 amp. to 10 amp., and 10 amp. to 18 amp. Any battery can be plugged into the voltmeter or ammeter circuits by push-buttons and switches. A double-throw switch provides for supplying charging current either from the main garage motor-generator or from a mercury-arc rectifier. Extension plug contacts are also provided so that the voltmeter on the panel may be applied to any outside cell within reach of the panel without permanently connecting the cell to the panel contacts. The cost of the installation was about $25.

How the Blow-Off Water from Boilers May Be Cooled Before Discharge Into Sewer

By T. W. Reynolds

A method of cooling the blow-off water from boilers and hot waste water from other sources before it is discharged into the sewer is shown in the accompanying illustration. This arrangement has been devised to meet the requirements of plumbing codes in cities where the discharge of blow-off water and hot drips directly into the sewer is prohibited. These codes



TANK AND PIPING FOR HANDLING BOILER BLOW-OFF WATER

stipulate that some form of condensing tank or coil must be used, and that the discharge be either to the sewer outside of the building and house trap or over a publicly placed, effectively trapped and vented sink supplied with water. This stipulation is made because of offensive odors caused by any water over 130 deg. Fahr., and on account of the alternate expansion and contraction of underground lead-calked pipe joints. Where tile pipe is used it is liable to be cracked, and the pressure within the system may force the seals of various plumbing fixture traps, thereby allowing the entrance of sewer gas into a building.

When the tank shown is in operation the hot water enters under pressure, the pressure is relieved through the vent, and the hot water leaves through the outlet to the sewer. The thermostat expands owing to the higher temperature of this water and opens a valve that admits city water pressure through the ⅛-in. pipe, which, acting on the reverse-action diaphragm valve, causes it to open. The admission of cold water through this pipe cools the hot blow-off water and condenses the steam and vapor. Waste from the ⅛-in. pipe is conducted to the sewer through a drip having a stop valve and sight glass.

The capacity of the blow-off tank should be proportioned to the boiler-horsepower which it serves. There is no fixed rule governing this size; however, in general, it is advisable to allow 15 cu. ft. of capacity for each single boiler of from 30 hp. to 100 hp. This is equivalent to a tank 36 in. in diameter and 72 in. in depth. Add for each 100 hp. of boilers or less 6 in. to the diameter and 12 in. to the depth. The deeper the tank, the less steam will be blown into the sewer. For boilers from 100 hp. to 200 hp. tanks should not be less than 48 in. in diameter and 72 in. in depth. Add for each additional 50 hp. or less 18 in. to the depth of the tank. There should be at least 30 in. between the water line and top of tank into which space the steam discharges, leaving a free opening for relief through the vent to atmosphere.

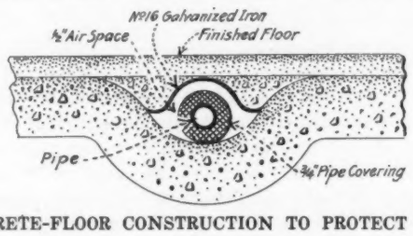
The blow-off and other hot water enters the basin near the top and leaves through the pipe extended to the bottom, the latter maintaining a water seal sufficient to prevent the entrance of sewer gas. The vent pipe should not be less than 3 in. in diameter for boilers up to 100 hp., 4 in. for 150 hp. to 200 hp., and 6 in. for boilers over 200 hp. It is advisable to bury the tank with its top set flush with floor and provided with either a removable cover or a manhole, yoke and cover accessible from the top for cleaning. All drain lines connected to the tank should be provided with check valves to prevent a back pressure from the boiler blow-off when in operation.

Transformer Drains Too Small

When transformers of large capacity are installed attention should be paid to arrangements for quick drainage whenever it becomes necessary to discharge the oil from the casings. The cost of completing a piping installation designed to carry the oil outside the building is small in proportion to the usual benefits and is preferable by far to drilling one or two holes an inch or so in diameter in the transformer compartment near the floor and trusting to such small outlets for the removal of oil in emergencies. Sometimes an elaborate concrete compartment is drained in this way and the provision for outflow of oil made so small that nothing like satisfactory working can be had when the occasion arises. Quick-opening valves and complete piping of liberal size are worth their moderate cost many times over in substation and generating-plant transformer bays.

Protection of Pipes When Buried Under the Floor

The accompanying sketch shows a method of protecting pipes together with their covering when they are run in a concrete floor fill. Inverted galvanized iron U-arches of No. 16 galvanized iron are placed immediately below the finished floor and directly over the pipes, with an allowance of ½ in. for an air space between the arch and pipe covering. The pipes are allowed to contract or expand independently of the floor construction, while the protecting of these from pos-



CONCRETE-FLOOR CONSTRUCTION TO PROTECT PIPES

sible contact with the cinder floor fill is also effected.

Where pipes are of necessity buried under floors in boiler or generator rooms or in floors with an unexcavated space below, they should be run in salt-glazed terra-cotta pipes, with water-tight cemented joints. The tile pipes should be of sufficient size to inclose fully the iron pipes, including all fittings.

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

Keeping the Electric Shop Awake and Working

Details of Sustained Activity in Providence, R. I.—and How It Pays to Hold the Public Interest

ABOUT the hardest problem of storekeeping that the electric shop must meet and conquer is the ever-present need of change. It is not enough to provide an attractive store and good display. The attracting power of the shop must never be allowed to falter, and as the public becomes accustomed to it

AN EXTRA WINDOW DESIGNED TO DRAW THE CROWD AND TURN ITS THOUGHTS ELECTRICALLY

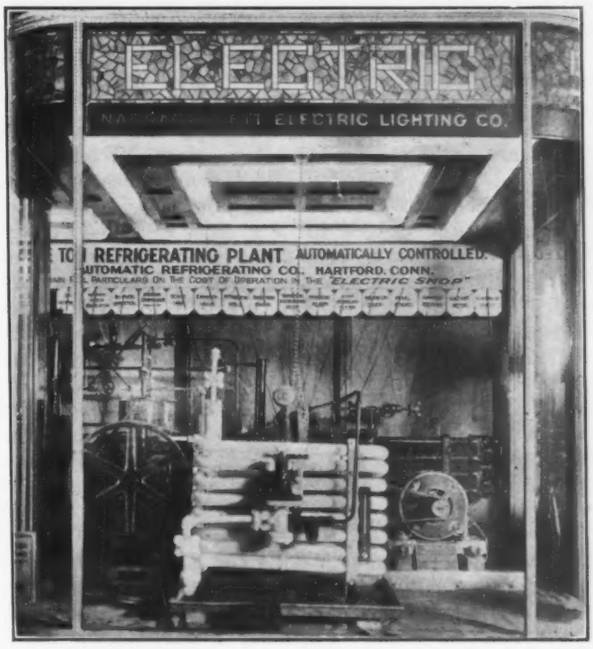
changes must be made continually to maintain its atmosphere of novelty and appeal. It is difficult but quite essential.

A Good Example in Providence

An interesting review of the activities of the Electric Shop of the Narragansett Electric Lighting Company, in Providence, R. I., was published in the ELECTRICAL WORLD of May 22 of this year, in which the general merchandising methods that have been employed in this successful central-station store were described in detail. It would seem that almost everything had been done to make this electric shop effective and that little change was needed to maintain it through the year to come. But Mr. E. R. Davenport, sales manager for the Narragansett company, is an enthusiastic merchant and on constant watch for opportunities to improve the selling influence of his store by a steady progress in the improvement of the smaller details of display and service. The following outline of innovations which have been introduced in the Providence merchandising methods during the first four months of this year illustrates how easily possible it is for any electric-shop manager to invoke the helpful influence of constant change and betterment if he but puts his mind to it.

War News and Portable Sales

During January the Providence Electric Shop contracted for daily war news service in the form of photographs and a frame for window use, at a cost of $2.75 per month, and in February this contract was extended to cover one year. The company sends the news photographs to its two branch offices after their use in the Electric Shop, which is down town, and thus obtains multiple exhibits without increase in cost beyond the expense of mailing. There was also effected at this time a considerable saving in the price tags used on displayed goods. Celluloid cards were used, which could be washed and re-lettered at little expense.



A MOST SUCCESSFUL REFRIGERATION WINDOW THAT PRODUCED MANY ACTIVE "PROSPECTS" WHICH RIPENED INTO BUSINESS

The company found it to be advantageous to purchase portable lamps in job lots from the various factories, and is taking advantage of the opportunity, thus saving materially on each lamp purchased, owing to the fact that the purchases are made when the factories

are not rushed and at a time when the makers are interested in a cash proposition. A feature has been made of portable-lamp window displays by the use of partitions to isolate each lamp and show it by itself in place of the usual method of exhibiting in groups. Arrangements were also made with a retail house in Providence to display a quantity of silk-shade portable lamps in its store at a substantial profit to the company. The concern agreed to assume all responsibility for the goods and also to advertise them. The reason these goods were thus placed outside was that the company believed that people who would purchase high-priced material of this grade would be more likely to frequent the store in question than they would the Electric Shop, making the former a better channel of distribution.

Window Activities

In January the window displays featured portable lamps for a large part of the month. Sixty-one lamps were sold, and the window displays alone were responsible for the sale of fifty lamps. Of these lamps fourteen were sold at a moderate percentage of profit, since these were equipped with silk shades and would have deteriorated if kept over the summer, but a gross profit of 33.3 per cent was made on the rest. The displays were usually changed every three days, and at the same time a smaller window was utilized in showing desk sets, shaving mirrors, small reading lamps, novelty lamps, bell ringers, etc., with good results. The Electric Shop window was also improved by the installation of a velours curtain, the effect being so pleasing that the company received many compliments from people connected with other stores in the city.

In April a window demonstration was conducted with a vacuum cleaner connected with a glass globe into which confetti was forced from the floor of the window. This made a decided hit with the public. In showing a bell-ringing transformer in the basement of the Electric Shop, the device was arranged so that the customer, by pressing a button, operated a bell and, by pressing another, threw a 2-cp., 6-volt night lamp into circuit in front of a clock face.

At Easter time an electric incubator and baby chicks were featured in a most attractive window display that interested every passer-by. On the approach of warm weather a complete refrigerating outfit was installed in the window and proved to be a most effective demonstration. The frost-covered pipes caught every eye, and the descriptive sign, marked with ribbons, covered every feature. This display resulted in thirty-three "prospects," and eight installations, aggregating a load of 87.5 hp., have been secured so far. This display was conducted by the power division of the sales department. Each person entering the store for information was turned over to an expert in charge of the apparatus and received a descriptive catalog in addition to an explanation of its service and cost.

Packages and Renewals

To make the packages leaving the Electric Shop more attractive, the company has adopted a light-blue wrapping paper and used imprinted tape bearing the name of the Electric Shop. Formerly a dark-drown Kraft paper was used, but the new type, imprinted with a seal designed for the shop, gives a distinctive package that carries a certain amount of advertising value.

A system of renewal charges on gas-filled lamps has been instituted, basing the charge on the hours of life derived from the lamp in much the same way as tires are renewed by automobile accessory dealers. Schedules of charges covering renewals from one hour to a thousand hours were prepared, and the practice was instituted of stamping on the lamp the date of sale in each case. This gives a check on the number of days the lamp has been out and aids in approximating the life of the unit.

Better Handling of Repairs

Special attention has been given to the prompt handling of appliance repairs of late, and the company has reduced the delivery cost from 35 cents per package in 1914 to 14 cents in 1915 by utilizing a parcel delivery service in place of the former delivery by an employee with a horse and buggy or by trolley-car patronage. Last year this equipment was distributed from the company's Electric Shop, but it is now sent out from the repair department direct, with a decided saving in handling and in time. This department, established at the company's waterside generating station, is now supplied with injured appliances at frequent intervals during the day, whereas formerly all this apparatus received was held until the end of the day before being sent to the repair shop. The present arrangement often results in appliances being delivered to their owners in twenty-four hours, a point that is appreciated by customers and which means the corresponding shortening of the time of zero energy consumption due to the absence of such equipment from the place of its service.

ELECTRIC SHOP SALES AND BUSINESS SECURED, 1915

	January	February	March	April
Sales:				
Number of appliances	176	142	178	283
Watts connected load	40,800	38,635	53,494	118,448
Gross sales, appliances	$1,097.59	$881.94	$1,127.21	$1,775.15
Profit on appliances	$383.05	$254.41	$321.96	$487.30
Business secured:				
Lighting, kw. connected	224.9	191.9	471.5	236.1
Lighting added income, estimated, per year	$4,897.00	$4,734.00	$16,734.00	$5,764.00
Motor service, hp. connected	235	580	287.25	698.6
Motor-service added income, estimated	$2,946.00	$11,609.00	$4,698.00	$14,149.00

The company handled 224 repairs in January, of which 90 were made in the repair department, and there were fourteen trouble calls on appliance repairs. The net cost of operating the repair department for the month was $89.63, against which the company received $27 for this service, which it maintains chiefly for the convenience of the customer. It is not expected that sufficient revenue can be shown from repairs to carry the department, but with the present system of charging on goods on which the guarantee has expired and also for parts which are destroyed through neglect or carelessness on the customer's part, such as broken flatiron handles, cracked plugs, etc., the customer is impressed with the necessity of reasonable care in using the equipment. On each cord repaired a tag is attached and returned with the cord to the customer explaining how to remove the plug from the appliance and how the cord became damaged. In the repair department a card system was inaugurated, showing the appliances and customers concerned with repairs, and rubber stamps were provided to save clerical work and enable the staff to devote as much time as possible to appliance maintenance.

Advertising and Results

In February a contract was signed for street-car advertising service, using 130 cars running in the best residential sections. The cost for a three-month period was $104, and the sales department feels that the publicity gained was well worth while. The first two installations were cards advertising tungsten lamps. In this month also advertisements were inserted in five foreign-language papers, including Swedish, German and Italian. A contract was signed for four months'

service for moving lantern slides to be used in a local motion-picture theater. The slides cost $1.50 each and the service $3 weekly, the subject being popular heating devices and fans.

Various results of the four months' work are given in the tabulation of sales and new business for the first four months of 1915.

Despite the business depression, the company's service has been expanding faster than a year ago. Thus the power division added 98 hp. in connected load in January, 1914, compared with 235 hp. this year; 549.5 hp. in February, 1914, against 580 hp. in 1915; 266.5 hp. in March, 1914, and 287 hp. this year, and 621.5 hp. last year against 699 hp. in April, 1915. Larger power business is in sight as a result of the recent Brown & Sharpe contract, and the industrial lighting outlook is good.

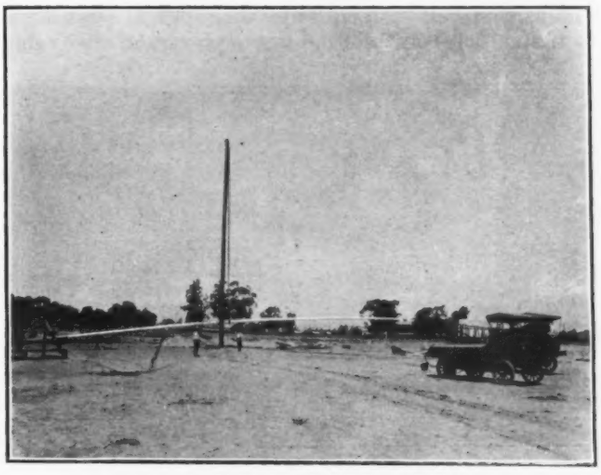
It is an interesting story of sustained activity and shows how consistently the electric shop may be maintained in its popular appeal and merchandising efficiency.

Raising a 135-Ft. Flagpole with Electric Trucks

Using two of its fleet of electric trucks, the Southern California Edison Company recently made a very successful job of raising a 135-ft. flagpole for the Los Angeles (Cal.) Park Commission. The Oregon cedar pole thus erected measured 20 in. in diameter at the butt and 8 in. at the top. As a preliminary to its erection the Edison crew first set and guyed a 70-ft. gin pole. Then two of the men put a sling around the flagpole at its center of gravity and made attachment to a 1.25-in. rope which was run through the pole tackle and three sheave blocks to the source of erecting power, which consisted of one 2-ton and one 1½-ton electric truck.

Superintendent Fred B. Lewis, who supervised the job, points out that the sling was so accurately placed that two men could handle the butt. The men who set the sling have become so expert that it is almost instinct with them to locate the center of gravity of the pole without measurements.

As soon as all attachments were made power was



A "TICKLISH" POLE-RAISING JOB IN LOS ANGELES

thrown onto the wheels of the two trucks, the slack was slowly stretched out of the rope, and then the trucks, going forward with a steady, smooth pull, raised the flagpole up to the required position while the butt was controlled by the men on the ground. The job was started at 10 a. m., and by noon the flagpole was up, the time given including the erection of the gin pole. Without the electric trucks the work would have required four teams and a much larger gang.

The erection of the flagpole was a rather "ticklish job," for the pole was a specially selected timber brought by sea from the North Pacific Coast and seasoned at Santa Monica for two years. When erected, the pole was completely painted, with its gilded ball on top and the flag lines in place.

An "Old-Business Department" to Serve the Company's Old Friends

In these days of strenuous upbuilding much may be heard of the "new-business department," of efforts to extend, to increase and to develop, but central-station managers should bear in mind that the company has old customers, old friends, whose trust and belief in its methods and its fairness enabled it to start and to develop to its present state—old customers who will need more motors or more energy-consuming devices as time goes on. This point was well presented by Mr. W. N. Matthews before a recent gathering of central-station men in the Middle West.

The requirements of a year or of five years ago unquestionably have changed. If old customers have been well served, they will welcome new ideas and suggested improvements that offer them benefit and lead to increased energy consumption; therefore the new business that is to be had by watchfully serving old customers should not be forgotten or neglected.

The need for an old-business department is evident from the fact that several men in one large city make a comfortable living by calling on the lighting company's customers and offering their services to check over electric light and power bills, to show the customer how he can get a better rate, secure more light by installing more efficient lighting units, or save power by putting in up-to-date motors or motors of smaller yet ample rating. One-half of the first year's saving is the usual charge for such service.

To cite a particular instance, a certain club which was using fixtures of the vintage of '95 and old-style 16-cp. and 32-cp. carbon-filament lamps was called upon by one of these free-lance adjusters, who recommended the substitution of 25-watt, 40-watt and 60-watt tungsten lamps. He sold the club tungsten lamps, which were inferior in quality to those being furnished on a practically free renewal basis by the lighting company, and he secured for them a substantial reduction in rate which, when taken with the reduced lamp wattage, amounted to about $400 a year. The house committee of the club was elated over the saving effected, and the news of the saving was made known generally among the 400 members, most of whom were prominent business men and householders in the community. In this case, if an old-business department had been on the job, it would have offered this saving for the club quite voluntarily, and the information spread abroad among the 400 members of the club would have made each a booster for the lighting company, instead of creating, as it did, a rather resentful attitude and a feeling of suspicion toward the company.

In short, as Mr. Matthews said, the sales department of the central station should put aside all thought of the distinction between "new" business and other kinds, and work for profits, just as any other manufacturer does, and the care and development of the present customer stand high in importance among the market opportunities.

Advising Customers Concerning Correct Lamp Voltage

The Cleveland Electric Illuminating Company, which does not sell lamps to its customers, has found that the local five and ten-cent stores are developing quite a business in buying at very low prices odd lots of lamps of different voltages and selling these lamps to customers on the company's lines. In some cases this

A SUGGESTION
In buying new incandescent lamps, note the wattage or "W" mark on the label. It tells you how much electricity the lamp consumes and determines the amount of light given out. Mazda lamps of from 15 to 60 watts are most suitable for home use.
394
THE ILLUMINATING CO.
Illuminating Bldg., Public Square
IMPORTANT!
40 WATT 110 VOLT 115
The voltage of an electric lamp is important. Be sure it reads V 115. If you use lamps of lower voltage, they won't last as long; if of higher voltage, they do not give as good light
THE ILLUMINATING CO.
Illuminating Bldg., Public Square
393
TO OUR CUSTOMERS
When you buy new incandescent electric lamps be sure to get the right voltage. For "Illuminating" service get 115 volt lamps—the label reads V 115. None other will do. Also be sure to get Mazda, not carbon lamps.
15 WATT 110 VOLT 115
THE ILLUMINATING CO.
Illuminating Bldg., Public Square
398

STICKER ADVERTISEMENTS TO EDUCATE CUSTOMERS IN THE PROPER SELECTION OF LAMPS

practice has caused users of electricity to become dissatisfied because the lamps burned out so quickly. To overcome this objection the company has had printed little stickers containing instructions concerning lamp voltage and is placing these stickers on all advertising matter given out. It is also publishing 1-in. advertisements in three of the Cleveland daily papers giving similar instructions.

Central-Station Service in Provincetown, Mass., Under Unique Conditions

Energetic commercial methods have been remarkably successful in popularizing electrical service at Provincetown, Mass., a famous summer resort at the "tip end" of Cape Cod. During the past year about 240 houses have been wired, and the local central station has 502 customers in a total summer population of 8000. Two-thirds of the summer cottages which dot the shore of the historic old town have been connected to the lines of the Provincetown Light & Power Associates, a company operated by C. D. Parker & Company of Boston, Mass.

Electricity at 20 Cents per Kilowatt-Hour

Three men have been constantly at work installing residence-lighting equipment for the past six months, despite the fact that as yet the company gives no day service and in the face of a rate of 20 cents per kilowatt-hour. Vigorous pushing of new business by the local superintendent, combined with an up-to-date commercial policy, including liberal advertising through local mediums, has done much to stimulate the demand for electrical service.

Several years ago the company was reorganized on the strength of a recognition locally that rates must be sufficiently high to enable the supply of electricity to be continued, and in this connection a widely signed petition in the form of special post cards was received by the company on behalf of an increase of rates.

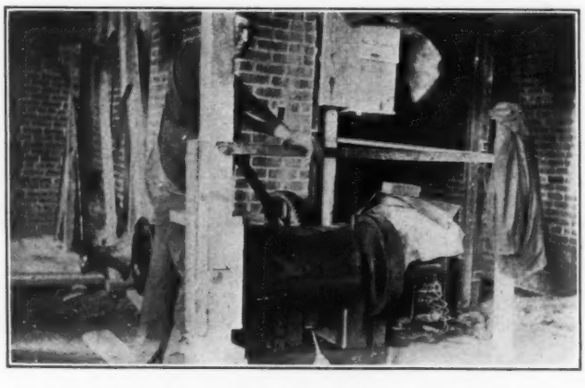
Under the present management an old oil-engine generating station in the outskirts has been discontinued in favor of a 125-kva. horizontal Curtis-General Electric 2300-volt turbo-alternator installed in the business center of the town and operated by steam generated in the boiler plant of a large local fish-storage establishment. The central station purchases energy at 3.5 cents per kilowatt-hour from the latter, and the service for all customers extends from dusk to dawn nightly.

The company has recently moved into enlarged offices, which it occupies in connection with the single local wiring contractor of the place. A well-selected exhibit of lamps, fixtures and domestic heating devices is a feature, and in spite of the absence of day service, electric irons are extremely popular in town and are used with appreciation in the evening hours. Easy chairs at the office, which is near the steamboat landing, the post office and the railroad station, render the premises attractive for tourists, and this summer the company is issuing a booklet showing the main automobile roads of Cape Cod, train and boat schedules, the tide schedules for July and August, and other information useful to visitors. From all summer cottages desiring electrical service a deposit of $12 for a three months' guarantee is required. This brings the guarantee to about $1 per week, but the cleanliness, convenience and safety of electric lighting as compared with kerosene lamps are strong points in the cottagers' minds in favor of central-station supply.

House wiring is done at an average cost of about $3.50 per lamp, and no carbon incandescents are used. In this work a deposit of about 10 per cent is required, and installment payments are permitted. There are only two stores in town not wired, and several moving-picture shows which lately have come to the place are proving excellent customers. As there is practically no manufacturing of any kind in Provincetown, the opportunities for motor service are meager at present, although the town water service may at some future time offer a field for electric pumping. The nearest village is 7 miles distant and as yet has no electrical service other than that utilized in the Highland Light naval radio station, which is not available for outside needs. Mr. H. F. McDonald is superintendent of the company, the electric-contracting business being handled by Mr. E. J. Rivard.

Central Station Rents Electric Hoists

Four months ago the Worcester (Mass.) Electric Light Company purchased a 1500-lb. electric hoist for about $400 and has since had the outfit in almost continuous service as a rented portion of building contractors' plant. The hoist, shown in the accompanying halftone, is equipped with a 10-hp., three-phase, 550-volt induction motor, 600 ft. of 0.5-in., seven-strand steel cable,



HOIST RENTED OUT TO CONTRACTORS IN WORCESTER

and a single drum, and it operates at 35 ft. per minute. The company rents the hoist to contractors at $15 per week plus the energy charge, which usually runs from $1 to $1.50 per day. The device is popular among contractors on account of its cleanliness and quiet operation. The illustration shows the hoist in service at the new building of Armour & Company.

A Novel Office Directory and Appliance Display

Customers of the Pacific Light & Power Corporation of Los Angeles on visits to the company's offices formerly experienced some difficulty in finding the proper places to have their wants attended to. The offices of the corporation are on the sixth floor of the Pacific Electric Building, and its patrons often found their way into the wrong department, although there was a directory in the lobby of the building giving the office numbers of the various departments.

A SHOWCASE IS SUBSTITUTED FOR THE ORDINARY LOWER PANEL OF THIS DOOR

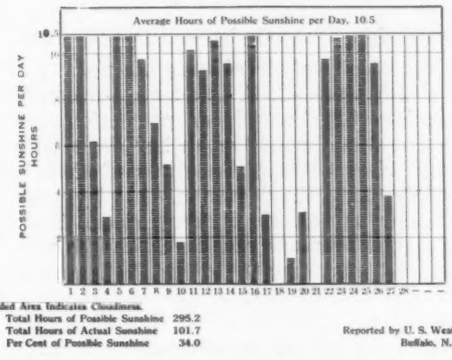
Immediately in front of and across the corridor from the elevators are the offices of the new-business department, which can be entered by two separate doors, one door being directly in front of the elevators.

The following novel scheme was suggested by one of the salesmen: The entrance opposite the building elevators was closed and a special door was designed to replace the regulation door. The upper three panels, as shown herewith, contain a complete directory of the different departments of the company with their respective room numbers, special attention being called to the proper rooms in which to pay bills and make application for service.

In the space occupied by the two lower panels a compartment was constructed for the display of electric lamp-socket appliances. The directory and appliance display are illuminated day and night by means of concealed lamps, and the appliance display is changed from time to time, giving prominence to special appliances on which the corporation may be making extra inducements. The entire door cost, installed, about $75 and has paid for itself many times over in saving the time of the public and employees.

Using a Sunshine Chart to Advantage

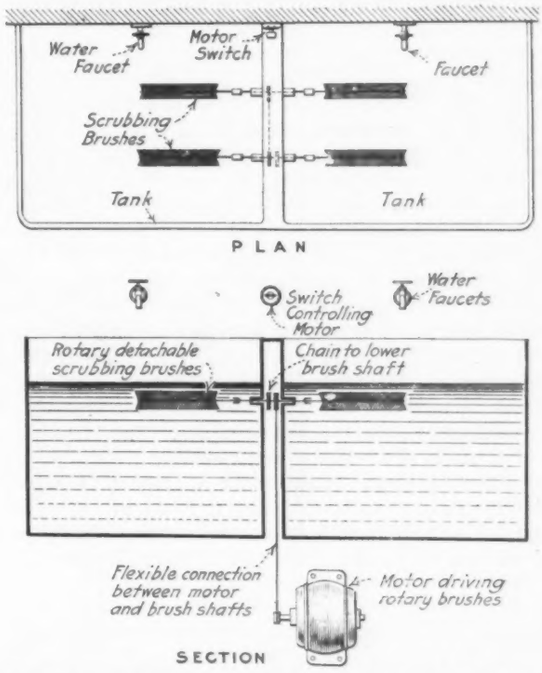
To show its customers the relation between daily sunshine and their electric-lighting bills, the Buffalo & Niagara Falls Electric Light & Power Company, Niagara Falls, N. Y., issues monthly advertising cards one side of which is taken up with a chart showing the hours of sunshine for each day of the preceding month. The possible hours of sunshine during the month form the basis of the chart, and the actual hours of sunshine are indicated by white spaces, the shaded areas indicating hours of cloudiness. The data used are reported daily by the local office of the United States Weather Bureau.


Average Hours of Possible Sunshine per Day, 10.5
POSSIBLE SUNSHINE PER DAY HOURS
Shaded Area Indicates Cloudiness.
Total Hours of Possible Sunshine 295.2
Total Hours of Actual Sunshine 101.7
Per Cent of Possible Sunshine 34.0
Reported by U. S. Weather Bureau, Buffalo, N. Y.

MONTHLY SUNSHINE CHART DISTRIBUTED BY THE NIAGARA FALLS CENTRAL STATION

Rotary Brush for Washing Arc-Lamp Inner Globes

Having small openings, the inner globes employed with inclosed arc lamps are usually hard to clean by hand. To facilitate removing the deposit that is formed in these globes, the Newark arc-lamp department of the Public Service Electric Company of New Jersey employs motor-driven rotary scrubbing brushes immersed in water, as shown herewith. The water is held in a rectangular tub which is divided into two parts



MOTOR-DRIVEN BRUSHES FOR CLEANSING ARC-LAMP GLOBES

by a double-walled vertical partition. Passing through the walls and parallel to the tank bottom are two shafts connected to the driving motor by chains. In the ends of both shafts can be inserted cylindrical brushes. The globes are thus held over the revolving brushes and are cleaned much faster than they could be by hand. If it is necessary to use some cleaning compound in the water to remove the deposit, this can be added without hindering the operation of the motor.

Complimentary Key Chains as Advertisements

As a means of advertising and to promote its friendly relations with the customers, the Metropolitan Electric Company of Reading, Pa., has been giving away sterling silver key chains bearing the company's trademark in red enamel. The chains are numbered and a record kept at the company's office so that in the event of a lost chain being found it may be readily identified and returned to the owner. Across the front is the inscription, "Do It Electrically." These chains are proving very popular gifts, and as they are expected to serve as constant reminders of the company, they are bound to do considerable good.

Technical Advance in Theory and Practice

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

High-Frequency Alternators.—A note on a recent British patent (No. 19,445, 1913) of M. Breslauer for a high-frequency alternator with the armature windings of full pole pitch arranged in the armature so that the center line at right angles to their plane is staggered in relation to the center line of the salient poles of the armature by half a pole pitch for the purpose of multiplying the number of alternations of the current without simultaneously increasing the number of reversals in the magnetization of the iron.—London *Elec. Eng'ing*, July 15, 1915.

Alternating-Current Commutator Motors.—Marius Latour.—The chief difficulty of alternating-current commutator-motor design lies in getting a high output per pole with few sets of brushes and small size of commutator. The author describes some machines recently built according to his designs by a French company. First he mentions some three-phase series commutator motors with vertical axles with a capacity of 500 hp. each, running at speeds between 500 and 700 revolutions, in a Paris plant. Synchronism corresponds to 600 revolutions at a frequency of fifty cycles. The number of poles is ten. The rating per pair of poles is therefore 100 hp. The number of sets of brushes is twelve. The length of the commutator is 40 cm. The connections are shown in Fig. 1, which illustrates transformation from three-phase to twelve-phase. The larger number of phases reduces the commutator difficulty. The same object is also obtained by a particular winding used ("imbriqué ondulé"), which is shown in Fig. 2 To permit starting and operation at low speeds with good commutation the star-delta connection is used as

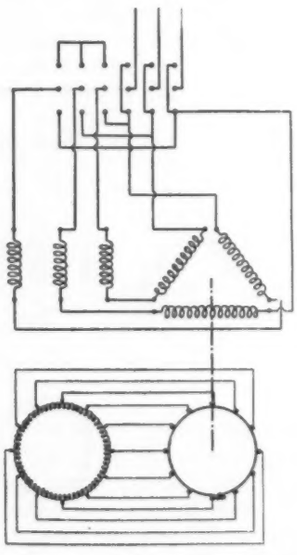


FIG. 1—STAR-DELTA SCHEME OF WIRING

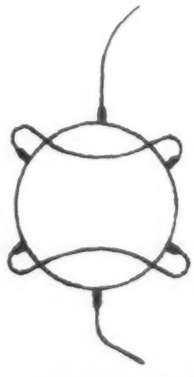


FIG. 2—"IMBRIQUÉ ONDULÉ" WINDING

shown in Fig. 1. The author also mentions some other machines built by the same company for the Montsouris plant. These are single-phase motors operated at a frequency of forty-two cycles with an output of 200 hp. each. They are compensated repulsion motors, and are also provided with the "imbriqué ondulé" winding. In these motors there is also employed the principle of

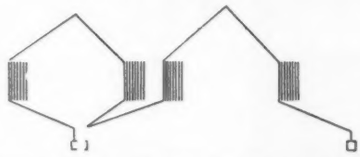


FIG. 3—METHOD OF MULTIPLICITY CROSS-CONNECTION

multiplicity cross-connection as shown in Fig. 3.—*La Lumière Elec.*, June 26, 1915.

Lamps and Lighting

Rating of Incandescent Lamps in Germany.—The Siemens-Schuckert company in an advertisement writes as follows: "Up to now electric incandescent lamps have been placed on the market rated by candle-power. For carbon lamps and normal metallic-filament lamps generally the mean value of the candle-power measured in a horizontal direction (perpendicular to the axis of the lamp) has been employed for the rating. Since the light emission of these lamps is less in all other directions, the true candle-power of such lamps calculated under the assumption of a uniform emission of light in space (the mean spherical candle-power) is about 20 per cent below the nominal value. The development of the incandescent-lamp industry in recent years has led to special designs, the purpose of which was to produce the maximum candle-power in a direction different from that which was heretofore normal. Half-watt lamps which were to compete with other strong sources of light [arc lamps] were originally rated according to the mean lower hemispherical candle-power, the measurement being made with the fitting applied to the lamp. The ambiguity in the meaning of candle-power has caused uncertainty among consumers, and this is likely to produce misunderstandings. Therefore the desire has manifested itself to find a uniform and clearly defined rating for all types of lamps. It has been found desirable to use in future the total watts consumed by an incandescent lamp for the rating, stating at the same time the mean spherical candle-power. This permits the consumer to calculate for himself the total operating cost of a lamp per hour of lighting on the basis of the established price of 1 kw.-hr."—*Elek. Zeit.*, June 24, 1915.

Generation, Transmission and Distribution

Protecting Electrical Machinery Against Abnormal Electrical Conditions.—C. C. Garrard.—A continuation of his long illustrated article on protective apparatus. In the present installment the author deals with localized pressure rises between the turns of electrical machinery and discusses the degree of sensitiveness of electrical machinery as regards pressure rises. The author then takes up the pressure rise due to causes exterior to the system and discusses the direct lightning strokes, induced charges and discharges due to lightning, lightning effects due to static induction, lightning effects due to electromagnetic induction, static charges, and traveling electric waves of steep wave front.—London *Electrician*, July 9, 1915.

Traction

Portugal.—W. REINHART.—A review of the present status of electric traction in Portugal, which has so far only five street-railway systems. Among these that of the city of Lisbon is most important. It has a length of 93 km. (56 miles) with 280 motor cars and twenty-four trailers. The system at Braga, which has a length of 8.5 km. (5 miles) and which is supplied with electricity from a steam plant, is to be the nucleus of a system of interurban railways in northern Portugal which will be operated from water-powers.—*Elek. Kraft. u. Bahnen,* May 24, 1915.

Electric Traction.—J. CARLIER.—The first parts of what promises to become a long illustrated serial on electric traction on trunk railways. In the present installments historical notes are given, together with tables of data on the most important electrically operated trunk lines in different countries of the world. The author discusses the possibility of increasing the average speed of trains and the inferiority of the steam locomotive, and compares the direct-current, three-phase and single-phase systems of electric traction. He then discusses overhead-line and third-rail construction.—*La Lumière Elec.,* June 19 and 26, July 3, 1915.

Installations, Systems and Appliances

German Electrical Industry.—C. HEISS.—On the basis of a publication of Czwalina, the author gives statistical data on the number, age, etc., of employees in different branches of the German electrical industry.—*Elek. Zeit.,* June 10, 1915.

Battery Reserve for Single-Phase Railroad.—W. LINKE.—The Albthal railroad from Karlsruhe to Broetzingen is a single-phase railroad operated at 8800 volts and twenty-five cycles from a steam-power plant, which serves not only for traction but also for lighting and general power purposes. Each of the three steam engines is connected with a single-phase alternator for traction and a three-phase alternator for lighting and power. There are three three-phase generators (two of 420 kva. each and one of 160 kva.) operating at 600 volts and sixty cycles and supplying current for lighting and power. There are three single-phase generators (two of 590 kva. and one of 365 kva.) operating at 8800 volts and twenty-five cycles and generating current for traction. These generators act in co-operation with a storage battery of 285 cells with a capacity of 1000 amp.-hr. (if discharged in one hour), operating in parallel with a motor-generator set composed of an 8800-volt single-phase generator and a 500-kw., 590 to 780-volt direct-current dynamo. Some details are given of the connections of the battery used as reserve, together with results obtained in actual practice.—*Elek. Kraftbet. u. Bahnen,* June 4, 1915.

Moscow.—KIRPITCHNIKOV.—An article, illustrated by diagrams, on the development of the central-station system of the city of Moscow, Russia. The first station was erected in 1888 and the direct-current system was employed, with a potential of 120 volts to 130 volts. The rate was 26 cents per kilowatt-hour for "technical applications" and 33 cents per kilowatt-hour for lighting. A discount was allowed to consumers using energy for more than 600 hours. The maximum rating which this first station reached was 2000 hp. in 1897, and in 1896 there were sold 870,000 kw.-hr. to 800 consumers having 25,000 incandescent lamps. In 1895 the company obtained a new franchise for fifty years. The rate was fixed at 26 cents per kilowatt-hour for lighting and 18 cents for motor-service purposes, the municipality to receive 6 per cent of the gross income for lighting and 3 per cent of the gross income for motor service. Fifty years after entering into the contract the city was to become the sole owner of the plant and the network. The new plant generates three-phase energy. Up to 1904 energy was sold almost exclusively for lighting, but then the use for power purposes began to increase. In 1913 the new station generated 89,000,000 kw.-hr.; that is, 100 times as much as did the old station during 1896. There was sold in 1913 to consumers 75,000,000 kw.-hr., or 890 kw.-hr. per kilowatt installed. The development of the equipment of the station is sketched.—*La Lumière Elec.,* June 12, 1915.

Electrical Regulations in Oil Districts.—L. STEINER.—A review of the new regulations of the use of electricity in the oil district of Roumania. These regulations were worked out to prevent accidents in future after various accidents had happened. The author describes special designs of switching and starting apparatus and lighting transformers worked out by the Siemens-Schuckert company and permitted for use by the Roumania mining department.—*Elek. Kraft. u. Bahnen,* May 14, 1915.

Netherlands.—H. VERHAGEN.—Extracts from the official report of the commission which has had under consideration a scheme for the systematic and rational electricity supply in the Netherlands. The present status is first discussed. On Jan. 1, 1913, there were in Holland eighty-two central stations. Of these twenty-four were municipal and ten also furnished electricity for traction purposes. Forty stations were privately owned, four privately owned stations belonged to traction companies, and fourteen stations were operated in connection with industrial plants. The total rating was 87,500 kw. In 1912 there were supplied 32,200,000 kw.-hr. for lighting, 33,800,000 kw.-hr. for motor-service purposes, and 31,400,000 kw.-hr. for traction, or a total of 97,400,000 kw.-hr. An estimate of the future demand for electricity in Holland is also given. At present steam is most generally used as motive power. Coal costs 0.3 cent per kilowatt-hour produced. One plant uses peat, the cost of the peat being 0.8 cent per kilowatt-hour. Diesel engines are used in several plants, the oil costing from 0.45 cent to 1.1 cents per kilowatt-hour. Twelve plants use gas, the gas costing 0.8 cent per kilowatt-hour. In Haarlem there is an experimental windmill power plant; for small communities, not easily supplied otherwise with electrical energy. wind may be suitable for prime movers. For the production of 30,000 kw.-hr. per year a windmill installation with a battery reserve to insure continuous service would cost $4,800, so that, with interest and amortization figured at 10 per cent, the cost is 1.6 cents per kilowatt-hour.—*La Lumière Elec.,* June 3 and 10, 1915.

Electrophysics and Magnetism

Electric Strength of Solid Dielectrics.—W. M. THORNTON.—The author shows that the work done in breaking down any solid dielectric is constant for that material and is independent of the thickness. This is shown to be true for solid dielectrics free from absorption (paraffin wax) as well as for inorganic and organic insulators which have residual effects.—*Phil. Magazine,* July 1915.

Magneton Theory of Atomic Structure.—DAVID L. WEBSTER.—An abstract of an American Physical Society paper. In a previous paper the author has shown that by means of Parson's concept of the magneton one may eliminate certain serious conflicts of Planck's theory of heat radiation with the phenomena of refraction and related optical effects, and still keep the essential features of Planck's argument. The present paper gives an account of the fundamental concepts of this magneton theory from the chemical point of view from which Parson originally deduced them. According to Parson, the electron, or magneton as he calls it, is not

a sphere but a very thin ring, 10^{-9} cm. in radius, around which the negative charge circulates at a very high speed, thus combining with its electrostatic properties the magnetic ones of a ring of wire carrying a current. As Parson has shown, the magnetons in an atom will arrange themselves as far as possible in compact groups of eight. This grouping will explain the periodic table of the elements and the formation of all salts and other compounds whose bonds are electrostatic. The non-electrostatic bonds of organic compounds are explained as a result of magnetic attractions not strong enough to draw a magneton over from one atom into the other. Thus the theory covers a much wider range of chemical phenomena than previous ones and even includes stability relations and the properties of the elements of the long periods. An added interest is given by the ability of this model to treat also such a widely different class of phenomena as those of radiation, referred to above, and those of optical rotation, for which the author has more recently found it an improvement over previous theories.—*Phys. Review*, July, 1915.

Electrochemistry and Batteries

Effect of Porosity on the Output of Storage Batteries.—C. Heim.—The ampere-hour capacity of a storage battery depends not only on the quantity of active material but also on the free access of the acid to the pores in the active mass during the discharge. The more rapid the diffusion of the sulphuric acid from between the plates into the pores of the plates the longer it takes until the acid concentration in contact with the active mass in the pores decreases so far that the emf. falls below the permissible discharge value. The author has made a series of experiments to determine how an increase of the porosity of pasted plates with a simultaneous decrease in the weight of active material affects the capacity of batteries. In order to produce active materials of different porosity he mixed the same weight of minium (lead oxide) with different quantities of sulphuric acid of 22 deg. Baumé. Four pastes, A, B, C and D, were made, which contained all the same amount of minium but different amounts of sulphuric acid, the weights of the latter being in the proportion of 100 to 121 to 143 to 171. The same quantity of glycerine was added to the four different pastes, this amount being negligible compared with the amount of sulphuric acid used. Exactly the same grids were used for all the plates, after which they were filled with the different pastes. The plates were then dried by a special process. While the apparent volume of paste was the same in the four types of plates, the weight was different, and therefore also the porosity was different. After having been dried, the plates were formed in the usual way into negatives, and those which were to be used as positives were later reformed for this purpose. The output tests were made with batteries containing all the same type of negatives, while for the positives plates of the four different types, A, B, C, D, were used. Other things being equal, the rating of the batteries with the type A plates was found to be 28.5 amp.-hr.; that of type B, 30.2 amp.-hr.; that of type C, 32.3 amp.-hr., and that of type D, 34.6 amp.-hr. In other words, by using a highly porous plate in D the output could be increased 21 per cent over that of A.—*Elek. Zeit.*, June 10, 1915.

Units, Measurements and Instruments

Optical Pyrometry.—Edward P. Hyde, F. E. Cady and W. E. Forsythe.—An abstract of an American Physical Society paper on various problems of optical pyrometry. These relate to the effective wave-length of transmission of red pyrometer glass, the temperature coefficient of transmission of red pyrometer glass, and the influence of the position of the rotating sectored disk in use with the Holborn-Kurlbaum type of pyrometer.—*Phys. Review*, July, 1915.

Current Transformer.—H. G. Nolen.—The author gives a circular diagram of the current transformer (transformer with constant primary current) for variable impedance in the secondary circuit with constant phase difference at the secondary terminals. He also gives a diagram for variable phase difference at the secondary terminals while the impedance in the external secondary circuit is maintained constant. Finally he emphasizes that for two special values of the phase difference the transformation ratio of the current becomes equal to the ratio of the number of windings so that the error for the current coil of the wattmeter becomes zero.—*Elek. Zeit.*, June 3, 1915.

Calculation and Measurement of Capacities.—J. Sumec.—In the proposed German rules for the definition of the capacity of multi-conductor cables, Maxwell's notation of the equations for the charging of a cable are used, as well as Maxwell's method of calculation of the partial capacities from which operating capacities are derived. But the author thinks they are of little use for engineering purposes. The author shows how the charge of any conductor can be calculated from the voltage and the partial capacities against every other conductor and earth; further, how the partial capacities can be measured directly (without making use of the "combination capacities"), and finally how the operating capacity can be found from the partial capacities.—*Elek. u. Masch.* (Vienna), July 4, 1915.

Telegraphy, Telephony and Signals

Pupin Coils for Telephone Lines.—F. Breisig.—The author points out that there is a certain discrepancy in European countries with respect to the design of telephone lines loaded with Pupin coils. Since such lines are liable to be connected together sooner or later, they should be designed with a view to uniformity so as to avoid wave reflections at the joints. The author explains the principle used in Germany that any part of a line which can be connected to or separated from adjacent parts should be designed with a view to symmetry. The "characteristic" of Pupinized lines (square root of the ratio of inductance per unit of length to the capacity per unit of length) is usually between 1000 ohms and 2000 ohms. The author recommends that lines which may be connected some day to other lines should be designed for a characteristic between 1400 ohms and 1800 ohms. The problem of distortion is connected to a certain degree with the number of coils used per wave-length. The difference of practice in different countries is indicated by the following figures: where 100 Pupin coils are used in German practice seventy-nine are used in British practice and 87.5 coils in American practice. The author thinks that undoubtedly the character of the languages of the different countries has something to do with this. Telephone lines connecting different countries should be so designed as to permit equally well the transmission of different languages. The author points out, however, that the degree to which a Pupinized line approaches its equivalent homogeneous line is probably not of so much importance for the transmission of speech as the leakage and the effective resistance of the coils, these two factors depending on the frequency. A more detailed experiment and theoretical investigation of this problem would be desirable.—*Elek. Zeit.*, June 17, 1915.

Miscellaneous

Technical Journals.—Artur Hruschka.—An article on technical journals and their "systematic utilization," with special reference to systems of classification, card filing, abstracting, etc.—*Elek. u. Masch.* (Vienna), June 20, 1915.

J. A. BRITTON

Men of the Industry

Changes in Personnel and Position— Biographical Notes

John A. Britton, first vice-president and general manager of the Pacific Gas & Electric Company, who returned recently from a vacation trip to Japan, has just been appointed a member of the public policy committee of the National Electric Light Association. Mr. Britton is a native of Boston, but in 1868, at the age of thirteen years, he went with his parents to San Francisco. There he received such education as the public schools afforded and afterward devoted two years to the study of law. His active career in the utility field was begun at the age of nineteen, when he entered the employ of the gas company at Oakland, Cal. Nine years later he was secretary of the company, and in 1894 he became its engineer, holding this post for several years until, in 1900, he was elected to the presidency of the company. Mr. Britton installed the first electric-lighting plant in Oakland, commencing operation in 1882 wth equipment rated at 125 hp. In March, 1903, the operation of the Oakland Gas Light & Heat Company was taken over by the California Gas & Electric Corporation, of which Mr Britton was then appointed general manager. In 1906 the California Gas & Electric Corporation was in turn taken over by the Pacific Gas & Electric Company, and in June, 1907, Mr. Britton was elected first vice-president and general manager of the last-named company. The Pacific Gas & Electric Company now serves two-thirds of the population of California, has 5770 employees, eleven hydroelectric plants and four steam plants, developing a total of 519,884 hp., operates sixteen gas works, and supplies electric, gas and water service to 349,252 consumers. Mr. Britton is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Gas Institute, the National Electric Light Association, the Pacific Coast Gas Association and the National Commercial Gas Association. He is also a member of the board of regents of the University of California and a director of the Panama-Pacific International Exposition Company.

R. S. Hale, superintendent of the special research department of the Edison Electric Illuminating Company of Boston, has returned from the business men's military camp near Plattsburg, N. Y., where he took part in the courses in military instruction. Mr. Hale is an expert marksman and on the rifle ranges at the encampment made a number of high records.

William W. Low, president of the Electric Appliance Company of Chicago, has just had an operation for appendicitis and is reported as recovering rapidly.

F. R. Cummings, for two years sales manager of the Empire District Electric Company, Joplin, Mo., has resigned to go to Birmingham, Ala., as assistant operating manager of the Alabama Power Company.

Dr. August Hund, late of the University of Karlsruhe, Germany, an authority on high-frequency alternating currents, has been appointed a member of the faculty of the electrical engineering department of the University of Southern California.

Capt. Albert Weston Grant, U. S. N., formerly of the superdreadnought Texas, who has just been appointed to have command of the entire submarine flotilla of the navy, has for years made a special study of the applications of electricity in the navy and on board modern battleships.

Gen. George H. Harries, president of the Louisville Gas & Electric Company, on his retirement as commander of the National Guard of the District of Columbia, was presented by the officers of the organization with a handsome sword and other equipment of his rank of major-general. The presentation address was made by Brigadier-General Harvey, and the equipment presented included the dress sword, appropriately engraved, a full-dress belt and sash, a gold belt knot and a pair of silver spurs. In responding General Harries advocated a country-wide volunteer army, with one month's training each year.

Stephen C. Pohe, the president-elect of the Pennsylvania Electric Association, is the general manager of the Columbia & Montour (Pa.) Electric Company and the Northumberland County Gas & Electric Company. Born at Espy, Pa., in 1885, Mr. Pohe received his early education at Catawissa, where he attended public school. He then studied at the Potts Business College in Williamsport, Pa., from which he was graduated in 1902, going to Berwick, Pa., where he entered the office of the Berwick Light Company, in time becoming assistant to the manager, L. J. Townsend. Upon the latter's death, in 1907, Mr. Pohe was made manager of the company, holding that

S. C. POHE

position for eighteen months. In January, 1909, the company was merged into the Columbia Power, Light & Railways Company of Bloomsburg, Pa., and Mr. Pohe was made superintendent of new business, with offices at Bloomsburg, which position he held until September, 1910, when he was appointed general superintendent. During the year 1912 a controlling interest in the property was purchased by H. D. Walbridge & Company of New York City, and the company was reorganized, the gas and electric properties under the name of the Columbia & Montour Electric Company, and the railway properties as the North Branch Transit Company. Mr. Pohe became general manager of both companies. In November, 1913, the Walbridge interests acquired control of the gas and electric properties of the Northumberland County Gas & Electric Company, operating in Sunbury, Selinsgrove, Northumberland and Milton, Pa., and at that time Mr. Pohe was made general manager of that company also, with offices in Bloomsburg. Mr. Pohe is a member of the American Institute of Electrical Engineers and of the Jovian Order.

Obituary

Edward B. Moore, former United States commissioner of patents, died at his home in Washington, D. C., on Sept. 8. Mr. Moore first entered the employ of the United States government in 1883, when he was appointed an assistant examiner in the Patent Office. Later he became a law clerk, and in 1899 he was appointed principal examiner, being made assistant commissioner in 1901. From 1907 until 1913 he served as commissioner of patents, resigning in 1913 to become a member of the patent law firm of Moore & Clark, of Washington. Mr. Moore was United States special commissioner to the Paris Exposition in 1900, and in 1908 he was the United States delegate to the International Patent Congress at Stockholm. He successfully completed in 1908 the treaty with the German government relating to the non-working of patents in Germany by American inventors and manufacturers.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Protective Apparatus for Alternating-Current Tie Lines

Single-pole, double-throw relays designed to provide a simple and effective means of automatically isolating

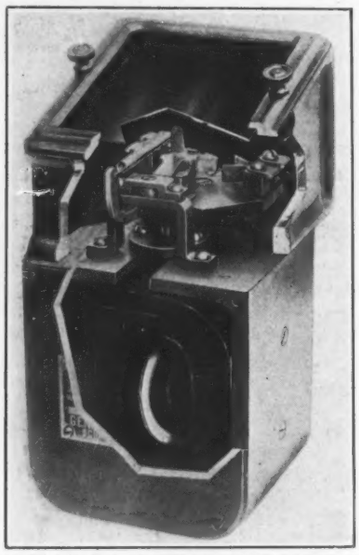


FIG. 1—SIDE VIEW OF REVERSE-POWER RELAY, SHOWING PART OF INTERIOR CONSTRUCTION

trouble on a single tie line joining parts of an alternating-current system have recently been developed by the General Electric Company, Schenectady, N. Y.

Under normal conditions, irrespective of the direction of energy flow, which may reverse at any time over the

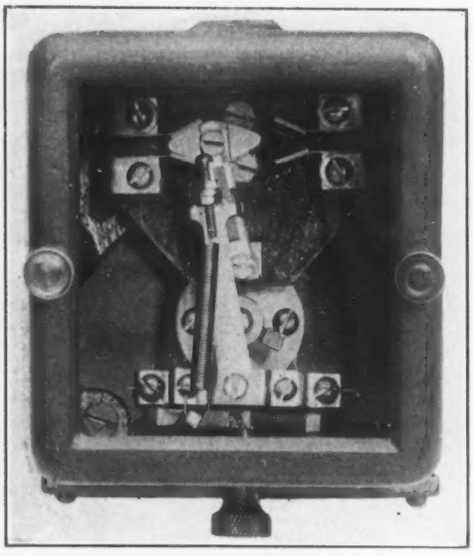


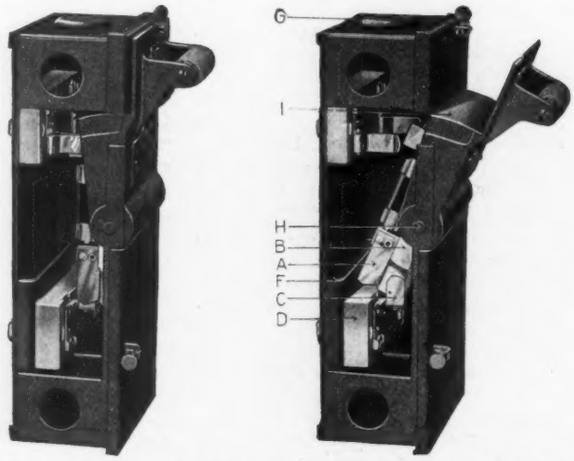
FIG. 2—TOP VIEW OF REVERSE-POWER RELAY, SHOWING METHOD OF OPENING AND CLOSING CIRCUIT

entire tie line, depending on the distribution of the load and also on the characteristics of the system, the relays have no effect on the oil switches. If, however, a short-circuit occurs in the tie line while energy is being fed from one part of the system to the other, this energy will go directly into the point of short-circuit, while the energy flowing in the tie line between the place of short-circuit and the part of the system previously receiving power will reverse and also flow into the place of short-circuit. This will operate the contacts of the relays in the reversed portion of the line, and this relay will cause the oil switches on both ends of the line to trip and isolate the line from the rest of the system.

The relays will not operate on overload or on account of trouble unless accompanied by a reversal of energy only on one end of the line which they are meant to protect. They will, however, operate when reversal of energy flow takes place, even though the amount of energy, the voltage or the power-factor of the line may be low.

Fused Switch That Prevents Replacement of Fuses While Switch Is Closed

The accompanying illustrations show a type of fused switch in which the fuses cannot be touched except when entirely disconnected from the circuit, as specified in the proposed safety code of the National Bureau of Standards. While the switch and cut-out can be readily reached, no current-carrying parts are made accessible by opening the switch either for the purpose of interrupting the circuit or to expose the fuses for inspection. Referring to the illustrations in which one side of the box has been cut open to show the construc-



FUSED SWITCH—CLOSED AND PARTLY OPENED POSITIONS

tion, it will be seen that the cover of the box is hinged at its middle point *H*, the upper portion of the cover swinging out of the box and the lower part swinging into the box. The flange *I* on the cover projects a sufficient distance into the box to keep the box effectively closed during the opening motion, until the contact *A* has broken its electrical connection with contact *C*. The porcelain base *B*, which is shown partly cut away, swings in close relation with the service contact base *D*, the baffle plate *F* and the bottom of the box, effectively blocking all access to the service terminal block *D* of the switch on which the service contacts *C* are mounted.

The box is provided with six conduit holes and interchangeable knock-out buttons, the arrangement being such that a conduit hole is available from any direction

of conduit run. The cover of the terminal chamber and the upper front cover are arranged for sealing and may be readily removed to facilitate wiring. These seals, however, do not in any way hamper the normal operation of the switch. The device is made by the Palmer Electric & Manufacturing Company, Boston, Mass.

Brush-Type Lever Switch

A lever switch of the Brush type designed for panelboard and switchboard construction where there are no live parts on the front of the board is being made by the Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y. The contact blades are of lami-

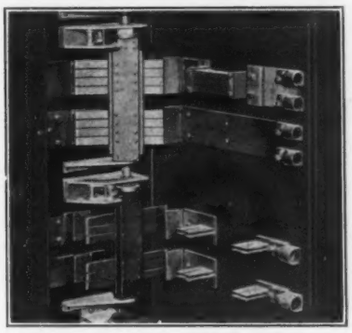
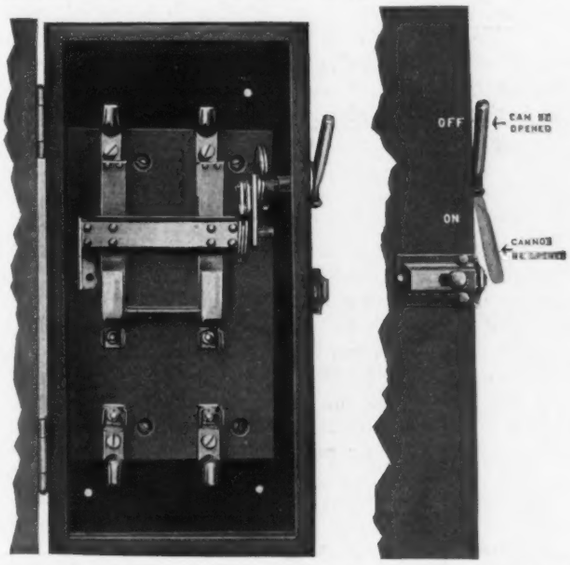


FIG. 1—BRUSH-TYPE CONSTRUCTION—REAR OF BOARD

nated construction and are held by a steel cross-bar which rotates between bearing blades on the base, so that each end of each brush is drawn against its respective terminal plate. The cross-bar is moved by means of an insulated handle. The manufacturer claims that with this switch a considerable saving in slate and in busbar copper can be made. The switch is mounted on the rear of the board, the laminated blades forming direct contact with the horizontal busbar which runs across the rear of the board and the fuse terminals mounted on the sides of the slate compartments. The outgoing leads are connected directly to the fuse ter-



FIGS. 2 AND 3—SWITCH IN CABINET, WITH DOOR OPEN AND DOOR CLOSED

minals by cables and run through the wiring compartments to a pull box at either the top or bottom of the switchboard. The space required from the front to the rear of the board is not more than 8 in. for switches of ordinary size and 12 in. for the larger-sized switches.

Contact Strips for Electric Signs and Lamps

In order to enable the wording of electric signs to be frequently and quickly changed when desired, and in order to provide means of enabling one to use lamps, appliances, etc., at various places in a room without

FIG. 1—SECTIONAL UNIT CONTACT STRIP

the use of long flexible conductors, a novel form of continuous contact strips has been developed by the Chase Electric Company, Chicago, Ill. These strips are made in various forms for exterior mounting on the fronts of buildings, around the edge of canopies, in lobbies, on bulletin boards, attached to the framework for roof

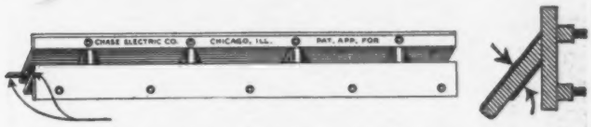


FIG. 2—CONTACT PARTS AND CONTACT HOOKS

advertising signs, etc. The strips can also be used to form slotted contact moldings for use embedded in interior walls of buildings such as libraries, clubs, hotels, residences and hospitals. In order to give flexibility to these strips, they are made in unit sections, which can be joined together by means of jointed steel sections.

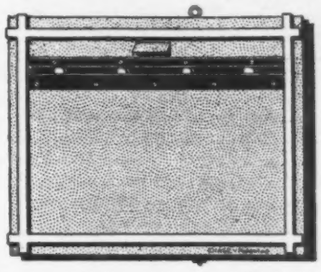


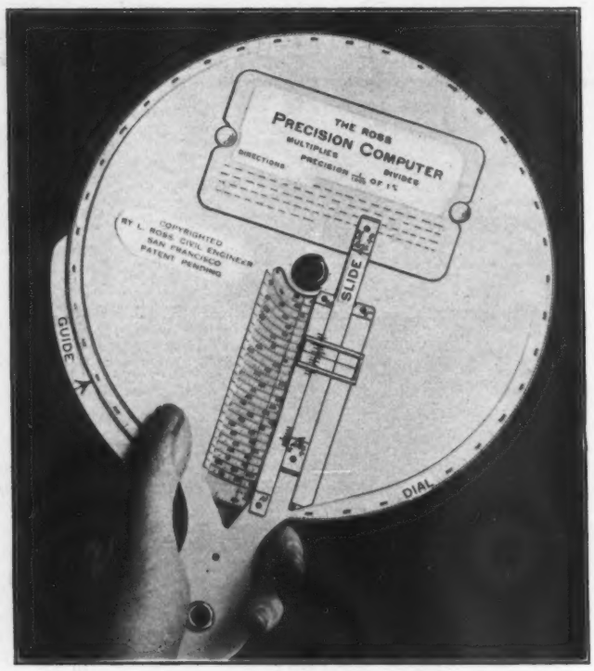
FIG. 3—CONTACT STRIP, WITH BACKGROUND FOR SIGNS

Two phosphor-bronze contact rails embedded in insulation compose these rails. Special contact hooks enable one to place sign letters or to attach lamps, fans, appliances, etc., to any point on the strips. Letters for use with electric signs made with these strips are provided with contact hooks, and the strips can also be furnished with background for the letters made of enameled steel.

"Readers of the ELECTRICAL WORLD may be grouped into three classes: users, recommenders and sellers of electrical appliances or apparatus. As the journal of an industry, the ELECTRICAL WORLD presents answers to three questions: 'Why?' 'How?' 'With what?' This department primarily concerns itself with the third question. It describes 'with what' plans and methods for widening the application of electricity may be put into practice. In fifty-two preceding issues something more than 1100 new apparatus and appliances have been described. During the fall months lighting equipment and supplies in all classes, domestic appliances in wide variety, electrical specialties for office, store and factory, industrial electrical appliances, and equipment for the economical generation and distribution of electrical energy, will be described, showing how such apparatus and appliances will help readers put their plans into practice."—ELECTRICAL WORLD, *Sept.* 4.

A Five-Place Calculating Device

A calculating device for engineers which measures only 8 in. in diameter, but which is capable of performing operations for which a slide-rule is generally employed having an accuracy of 1 in 100,000, has been developed by Mr. Louis Ross, San Francisco, Cal. This calculating device consists of a graduated dial rotating under a slotted cover, a floating guide, and a slide mounted at the right of the slot. The operation of the dial gives results to an accuracy of five significant figures throughout. An accuracy of three digits can be



8-IN. CALCULATING DEVICE FOR ENGINEERS

obtained by operating the miniature scale dial which ordinarily is used to check and point out the precise answer and to locate its decimal point. Variable graduations have been eliminated, the dial containing equal graduations.

To multiply and divide any series of numbers it is only necessary to set each number in succession under the reading line in the slot, the result being read under the slot line. The instrument may also be used for logarithmic calculations involving as many as five significant digits, also for performing such complex operations as power, roots, etc. Trigonometric calculations, it is claimed, can be made with an accuracy of from 3 to 5 seconds of arc.

The instrument is made of metal throughout, the graduations being engraved on silvered metal surfaces. It is made by the Computer Manufacturing Company, San Francisco, Cal.

Adjustable Lighting Brackets

Two types of adjustable lighting fixtures, one of which may be attached to the wall or horizontal surface and the other to the ceiling, as shown in the accompanying illustration, are being placed on the market by the Newman Manufacturing Company, 717 Sycamore Street, Cincinnati, Ohio. Numerous adjustments can be made with these fixtures, which are especially adaptable for use by machine, bench and desk workers. The manufacturer points out that any style of shade can be attached to the bracket. The bracket, which can be attached to the wall, lathe or bench, is made in two sections, each section being 18 in. long, making the bracket with attachment 40 in. long when in a straight extended position. The socket holding the bracket permits easy swiveling to any side position, and the two knuckle joints permit easy vertical adjustment. The bracket can therefore be adjusted to any angle or position desired. The joints are of cold-rolled pressed steel and are provided with friction disks. The ceiling type of bracket can be easily attached to the ceiling, it is declared, and by means of the friction-ball joint an adjustment of any desired angle can be obtained. The latter-named bracket is provided with telescoping rods, which can be raised or lowered to any desired height. The telescoping rod fits tightly in the pipe, so that no adjustment of thumb-screws or set screws is required. The brackets are finished in oxidized copper.

ADJUSTABLE WALL AND CEILING LIGHTING FIXTURES

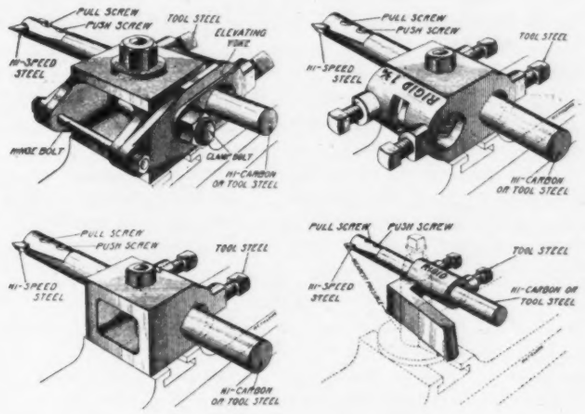
Rigid Boring-Tool System

A series of holders for boring tools in which special efforts have been made to obtain great rigidity have recently been placed on the market, having been developed by Mr. E. F. Gibbs, a mechanic in the United States Bureau of Engraving and Printing. The system consists of a special lathe boring bar made in ten sizes from 0.5 in. to 2.25 in. in diameter and four types of holders to meet various requirements. The bars are of solid crucible steel or high-carbon steel. Three of the four holders are one-piece tools. Tool steel is used for the port screws, which are extra large and elongated horizontally. The bars have two solid bearings in the port holes and take cutters of all sizes up to their respective limits.

The boring bar's cutter clamp is greatly strengthened by the action of the push screws shown in the illustrations, yet the normal exterior of the bar is not materially altered by the clamping mechanism. No special wrench is required, and the cutter, it is claimed, cannot tighten and affect the boring in any way, or unscrew and loosen in turning. The adjustable boring-tool holder

fits most lathes from 12 in. up. It has a broad square cast-iron base of great strength and rigidity. Its hinged elevating steel yoke which carries the bar is locked by the clamping nut at any exact elevation.

The double reversible steel holder is made in two sizes. It can be reversed horizontally and vertically so as to give four bar elevations from 1⅜ in. to 1¾ in., progressing by eighths. A ½-in. liner furnished with the holder makes it practically universal. The single



HOLDERS FOR BORING TOOLS

reversible cast-iron holder is also made in two sizes and is a one-piece rigid tool. It reverses vertically only and is intended for two specific lathes, to the elevations of which it is exactly fitted.

Another one of these holders is the tool-post boring-tool holder, which is made in seven sizes. It, too, is a one-piece tool especially designed for great rigidity. The angular opening between the shank and the barrel brings the strain-receiving cutter point as near as possible to the supporting tool-post wedge. The angularity of the opening also throws the cutter point directly in front of the wedge. These tools are being manufactured by the Rigid Tool Holder Company, Baltimore, Md.

Small Generating Sets

The Main Electric Manufacturing Company, 500 Aiken Avenue, Pittsburgh, Pa., has developed several types of small gasoline-engine-driven 30-volt generating

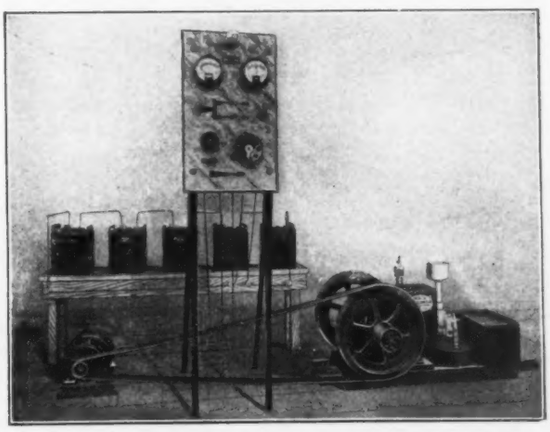


FIG. 1—GENERATING SET WITH RATING OF 200 WATTS

plants. In Fig. 1 is shown the "junior" outfit complete. The dynamo is belt-connected to a 1.5-hp. engine, as shown, and is designed to operate twelve 20-watt lamps. Either a 40-amp.-hr. or a 60-amp.-hr. battery of the inclosed type may be used with the outfit. The switchboard is of Vermont blue marble, and on it are mounted the meters, automatic circuit-breaker, rheostat and switches, fuses, etc. The shipping weight of the set with the 40-amp.-hr. battery is 600 lb., and with the 60-amp.-hr. battery 700 lb.

The set illustrated in Fig. 2 is rated at 0.75 kw. and is operated by a 1.5-hp. engine. Batteries of the

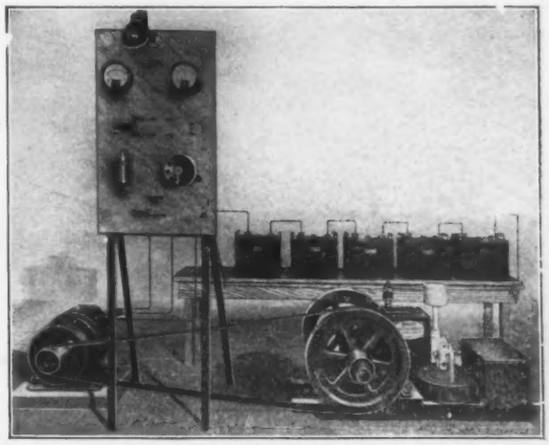


FIG. 2—30-VOLT, 0.75-KW. PLANT

inclosed type with ratings of 40 amp.-hr., 60 amp.-hr., 95 amp.-hr., 130 amp.-hr. and 165 amp.-hr. may be utilized, and the total shipping weights with the respective batteries are 900 lb., 1000 lb., 1250 lb., 1500 lb. and 1650 lb. The space occupied by the plant is 2.5 ft. by 8 ft.

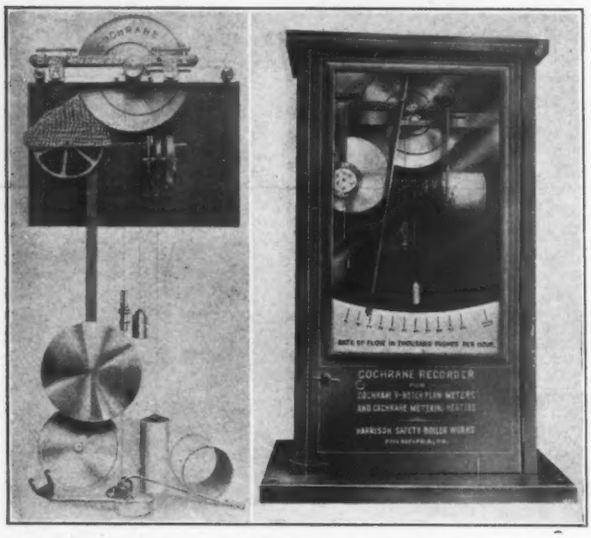
Recorder for Measuring Flow Over Weirs

With any type of weir or orifice the rate of flow is dependent upon the head and, once the law of the weir or orifice is known, may be calculated directly therefrom. For most purposes of measurement, however, mere knowledge of the rate of flow at a given instant is not sufficient, but continuous or total results are essential. Various types of flow recorders have, therefore, been developed, one of which is illustrated herewith. The apparatus includes a float which moves vertically in response to changes in head. With weirs or orifices where there is a free surface of the liquid on the upstream side, this float rests directly on the surface, whereas with Pitot tubes and Venturi tubes it ordinarily rests upon the surface of mercury in one of the legs of a U-tube, the ends of which are subject to the differential pressure due to the Venturi or Pitot tube.

If the motion of the float is employed directly to actuate the recording device, so that the motion of the recording pen is directly as the motion of the float, or in proportion to it, a record of rate of flow can be obtained, but the divisions on the chart are not in general equal for equal increments in rate of flow. It is therefore necessary to incorporate some kind of translating or modifying mechanism between the motion of the float and the motion of the recording pen. This translating mechanism is ordinarily a cam. Besides taking account of the law over the weir, the translating mechanism must also provide the proper ratio between float movement and pen movement. In the design of recorders for use with V-notch and rectangular weirs it is customary to make the total length of the cam much greater than the movement of the float, using a multiplying gearing between the float stem and the cam.

In the flow recorder shown herewith the cam is laid out as a spiral on a flat circular plate, and the multiply-

ing mechanism consists of a small drum mounted upon the spindle of the cam and having wrapped about it a thin metal cable which is attached to the float spindle, a counterweight on another cable serving to keep the first cable taut. The spiral groove is cut into the surface of the disk and is so arranged that the part of the cam corresponding to low heads is near the center of the disk, and the part corresponding to high heads is near the periphery of the disk, whereby the angle between a tangent to the cam at any point and a tangent at the



FIGS. 1 AND 2—RECORDER REMOVED FROM CASE, WITH CHART DRUM, PEN AND INTEGRATOR REMOVED, AND INSTRUMENT COMPLETE IN DUSTPROOF CASE

same point to a circle concentric with the disk is kept small, owing to the fact that what would otherwise be the steeper part of the cam is at the greater radius. To accommodate the recorder for use with weirs of different heights it is necessary only to substitute cable drums of the proper respective diameters. One cam serves for all weirs, having the same law connecting head and flow.

The chart being driven uniformly by a clock, the pen not only records the rate of flow at each instant but the area under the pen-trace is proportional to the total flow for any elapsed period. In other words, the user of this recorder is supplied not only with a history of the rate of flow, as, for instance, the rate at which his boilers have been fed throughout the day, but may also obtain by the use of an ordinary engine planimeter the total amount of water which has been fed to the boilers, and by comparing this quantity with the amount of coal used may determine the total and average evaporation for the day.

Many users, however, desire to obtain the total flow directly, without the use of a planimeter, and for this purpose an integrating attachment has been added. To meet another requirement a visible pointer moving along a large scale with open divisions has been added, making it possible to read the rate of flow from a distance away from the instrument.

The instrument is properly adjusted when the float is at zero position; that is, when the level of water upon which it rests is at the zero level of the weir, the cam must be at zero position, the pen on the zero line of the chart, and the integrator roller at the center of the aluminum disk.

One clock is employed with the instrument. It is equipped with a weight-operated pendulum movement, making eighty beats per minute. Both chart drums and integrator disk are attached directly to spindles of the clock train. The heavy propelling weight is suspended by a cable which winds over a drum, the spindle of which also carries the chart drum. This spindle is directly supported by ample bearings on either side of the cable drum and is connected by a flexible coupling to the first shaft of the clock movement. Inasmuch as the chart drum makes one revolution in twenty-four hours, this is the speed of rotation of the cable drum, which is of such diameter that the clock weight will fall a little less than half the height of the recorder casing in that time. When the record drum is removed a handle is exposed, by means of which the clock may be wound, the intention being that the operator shall wind the clock for a day's run when changing records, thus making it a regular routine that will become habitual. The weight used is of the size ordinarily used for eight-day clocks, and as it expends its entire energy in two days instead of eight days, the clock movement has considerable power.

The clock spindle which revolves with the weight drum carries at its other end a gear meshing with a pinion on the spindle of the integrator disk, the motion thus being transmitted directly. The integrator disk is on the same level with the chart drum, so that the two are side by side, symmetrically placed in the casing and at all times visible through the door, as shown in Fig. 2. A gear on the spindle of the integrator disk drives an intermediate pinion on the spindle of a gear which drives the escapement, giving altogether only three gear reductions from driving weight to pendulum.

The Cochrane flow recorder, as it is called, is being manufactured by the Harrison Safety Boiler Works, Philadelphia, Pa.

Ventilated Semi-Indirect Fixture

In the accompanying illustration a semi-indirect fixture is shown in which a small hole is drilled in the bottom of the bowl to cause a circulation of air in the proper direction. As a result the fixture is well adapted for use with gas-filled lamps. The reflector measures 17

SEMI-INDIRECT UNIT FOR GAS-FILLED LAMPS

in. in diameter and is white-enameled. Three straps suspended from the reflector engage the bowl. The bowl is of translucent glass, sand-blasted, and can easily be removed by spreading one of the three straps holding it. These fixtures are made for lamps up to 500 watts rating by the Cleveland Chandelier Company, Cleveland, Ohio.

Wiring Statistics for the City of Philadelphia.—In the annual report of the electrical bureau of Philadelphia for 1914 it is shown that on Dec. 21, 1914, there were 87,761 poles and 18,754 miles of overhead wire on city streets and 8,052,474 ft. of conduit, 61,268,368 ft. of duct and 556,030 miles of conductor under city streets. There has been a gradual decrease in the mileage of overhead lines since Dec. 31, 1910, and an increase of underground circuits.

Kansas City's Fall Festival Electric.—The Kansas City Electric Light Company is completing its plans for the "fall festival electric," which will be held at the Electric Shop Sept. 30 to Oct. 11. All devices except vacuum cleaners and washing machines will be sold at 20 per cent discount. Local manufacturers and jobbers are co-operating, as in the past, and the event will be advertised in many unusual ways. As heretofore prizes will be given, but this year these prizes will consist of definite amounts of electric service, the commodity the sale of which the festival is designed to extend and augment.

To Fight Bagdad Mosquitoes with Electric Fans.—Electric fans of great size and power form an important part of the equipment with which two intrepid American adventurers purpose to exterminate the gigantic mosquitoes which infest the caliph's palace at Bagdad. According to the unimpeachable testimony of a newspaper interviewer who talked with these Jersey experts just before they sailed for the banks of the Euphrates at the caliph's royal invitation, the electric fans are to be used to blow the aroma from a powerful narcotic through the rooms of the palace, causing the mosquitoes to fall into a condition of coma, when they can be swept up by thousands and destroyed.

Atlantic City's Electric Signs.—In reply to a recent agitation at Atlantic City, N. J., looking to the removal of all overhead and roof electric signs, an interested citizen offers the following estimate of the value of the local electrical displays: "Space for signs on top of buildings facing the Boardwalk rents for from $300 up to $1,500 a year. I have heard it said that in one or two instances $2,000 is paid, but I do not believe this. As for the charges that the signs create fictitious values, I know that in one instance $800 derived from the rental of a sign space made it possible to take $200 per annum each off the rental of four stores and thus helped the lessees without doing the landlord any harm. And that isn't all by any means. Take down the signs and the city will have to spend $25,000 a year more than at present to make up for the lost illumination."

Automobile Output of the United States for 1914 Was 700,000 Cars.—Statistics on the manufacture of automobiles, both gas and electric, in the United States for last year, collected by the Automobile Chamber of Commerce, place the number of cars built during the twelve months ended June 30, 1915, at 703,527. These cars are valued wholesale at $523,463,803, which is an advance of 36 per cent in the number of cars, and more than 10 per cent in value over the previous year. Sales of passenger cars of all types to June 30, which is the end of the year in the industry, were 665,826, for which the manufacturers received $450,941,131, while the sales of commercial vehicles of all types are estimated at 37,700, valued at $72,522,692. The figures for twelve months ended June 30, 1914, were 515,101 cars, passenger and commercial, valued at slightly more than $485,000,000. More than 2,000,000 cars are now registered in the United States, based on the reports of the States which require registration.

Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

Los Angeles Passes Wiring Ordinance.—The new electric-wiring ordinance for Los Angeles, which has been under discussion for nearly two years, has been passed by the City Council. The principal feature of the ordinance requires that all wiring installed in residences and other buildings must be inclosed in metal conduits and all outlets must be of approved design and construction. The ordinance, while it is patterned after the model specifications of the National Fire Protection Association, exempts small cottages and bungalows of inflammable construction, and the danger to such structures, which are very popular in Southern California, will be as great as formerly. The city's electrical department is working on a revision of the building code, and it is proposed that the new regulations shall be enforced strictly. Recent inspections have shown that the storage of goods in attics has become a source of fire hazard, especially in the residence district, and efforts will be made to require all electric wires in attics to be protected.

A 25,000-Subscriber Telephone Exchange for Chicago.—What will be one of the largest telephone exchanges in the world is now being completed by the Chicago Telephone Company at 6041 Kenwood Avenue, Chicago. The original equipment will serve more than 25,000 telephones, which is a larger number of instruments than are in use in the whole city of New Orleans or Jersey City, N. J., and more telephones than are in service in the countries of Greece, Portugal, Serbia and Bulgaria combined. The "A" switchboard of the exchange, where all incoming calls are received, will have positions for nearly 100 operators and will extend in a continuous line as long as half a city block. The distributing frame, where the cables containing the wires that connect subscribers' telephones terminate, is the largest frame of its kind ever installed. Three separate exchanges—Hyde Park, Midway and Blackstone—will be housed in the new office building at the outset, and the structure is large enough to care for three additional exchanges, which it is expected will be required in this company's territory ultimately.

Educating Meter Testers. — The meter testers of the Duquesne Light Company of Pittsburgh, Pa., are accurate and experienced wiremen who have been advanced. In order to check up their work thoroughly and accurately and so remedy any defects, the company has caused an educational test board to be erected on which is installed one of each of the various makes and types of meters in use on its lines. There are five makes and twenty-six types. The meters on the board are purposely put out of calibration and defects introduced, all of which the tester is expected to remedy. When his work is completed the foreman checks up the meters and thereby informs himself of the tester's ability, knowledge and workmanship. Over each meter is a slip of paper with a typewritten name and address of the customer on whose premises the meter is supposed to be installed, and the tester is required to write up a report of the test accordingly. This examination is proving of value in enabling the testers to discover their own deficiencies and in raising the standard of work. The board also enables the apprentices in the meter department to learn the characteristics of the various types of meters.

Calculation of the Strength of Electric Currents.—The Bureau of Standards, Washington, D. C., has just published Scientific Paper No. 255, entitled "The Calculation of the Maximum Force Between Two Parallel, Coaxial, Circular Currents." The paper contains a formula which gives the critical distance as a function of the ratio of the radii of the coils. Probably the most accurate method for the determination of the value of the strength of an electrical current in absolute measure is by means of the Bayleigh current balance, in which the current to be measured is passed in series through two parallel circular coils of unequal radii, one of which is suspended from the beam of a balance. The distance between the planes of the coils is varied until the force of attraction between the two coils is a maximum, and the value of the force is obtained by adding weights to the other arm of the balance until its equilibrium is restored. Since the maximum force obtainable depends on the ratio of the radii of the coils alone, and not on their individual dimensions, it is necessary only to determine further the ratio of the radii of the coils, and this may be done with great accuracy by electrical means. The formulas given in the paper are illustrated by numerical examples and tables, and the new formulas are shown to give results in agreement with those derived by the more indirect and laborious method of interpolation.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associations and Societies

Vermont Electrical Association.—The midsummer meeting and outing of the Vermont Electrical Association was held at Rutland, Sept. 9 and 10, this being the week of the Rutland fair and carnival. It was planned to have a clambake on Sept. 10. C. H. West, Rutland, Vt., is secretary-treasurer of the association.

Mississippi Electric Association.—The annual meeting of the Mississippi Electric Association will be held at Hattiesburg, Nov. 10 and 11. There will be no papers at the convention, the time being given over to discussions of subjects of interest to all. These subjects will be decided upon by a committee appointed by the president.

"Electrify Dallas."—The Dallas (Tex.) Electric Club has taken as its slogan the motto "Electrify Dallas," and already has a large membership enlisted in this campaign. At the August meeting J. H. Mosely was appointed editor of *Kilowatts*, the club's little bulletin, which will hereafter be issued monthly. The resignation of H. S. Cooper as secretary has been accepted and E. N. Willis has been elected to the office of secretary-treasurer. Communications to the secretary's office should be addressed to 1701 North Market Street, Dallas.

Conventions Next Week.—As already announced in these columns, the following conventions are scheduled for next week: Association of Edison Illuminating Companies, Spring Lake, N. J., Sept. 13 to 15; Institute of Radio Engineers, San Francisco, Cal., Sept. 13 to 18; Electrical Supply Jobbers' Association, Niagara Falls, Ont., Sept. 14 to 16; New England Section, N. E. L. A., Mount Kineo, Me., Sept. 14 to 17; American Electrochemical Society, San Francisco, Cal., Sept. 16 to 18; American Institute of Electrical Engineers, San Francisco, Cal., Sept. 16 to 18.

Revision of A. I. E. E. Constitution.—The constitutional revision committee of the American Institute of Electrical Engineers has notified the membership urging it to submit suggestions on the revision of the constitution of the society through the secretary by Oct. 1. On account of the requirements of the constitution relating to the adoption of amendments, it is necessary that the committee shall formulate its recommendations regarding amendments within the next few months if there is to be any action during the present administrative year. Bancroft Gherardi is chairman of the constitutional revision committee.

Program for Convention of Southeastern Section, N. E. L. A.—The annual convention of the Southeastern Section of the National Electric Light Association, as already announced in these columns, will be held at Asheville, N. C., Sept. 22 to 24, with headquarters at the Grove Park Inn. At the opening session of Wednesday afternoon Mayor Rankine of Asheville will deliver the address of welcome, the response to which will be presented by E. C. Deal. Capt. W. T. Weaver, president of the North Carolina Electrical Power Company, will follow with an address on the topic of hydroelectric development. At the public-policy session of Thursday evening Governor Craig of North Carolina will speak on the public relations of utility companies. Among the papers to be presented at the technical sessions are the following: "Accounting," A. A. Wilbur, Columbus, Ga.; "Advertising and Its Direct Relation to the Central-Station Field," J. J. McManus, Harrison, N. J.; "Electric-Heating Devices," W. M. Stearns, Pittsfield, Mass.; "Efficiency in Serving the Consumer," J. M. Mohl, Cordele, Ga.; "Electric Power for Driving Textile Mills," H. A. Orr, Anderson, S. C.; "Distant-Control Switchboard Design," Stephen Q. Hayes, Pittsburgh, Pa.; "Sale of Energy to Municipally Owned Distributing Systems of Street Lighting," W. Rawson Collier, Atlanta, Ga.; "High-Tension Systems and Their Operation," W. E. Mitchell and H. H. Dewey, Birmingham, Ala.; "Electric Drive in a Cottonseed-Oil Mill," J. W. Ruff, Charleston, S. C.; "Taxes and Public Service Companies," H. H. Carr, Raleigh, N. C.

E. V. A. Cleveland Meeting to Be an "Efficiency Convention."—In view of the heavy drain on business organizations resulting from the "convention habit," it has been determined to make the coming meeting of the Electric Vehicle Association at Cleveland, Ohio, Oct. 18 and 19, an "efficiency convention," and to this end the meeting will be a working session throughout. Following is a list of some of the papers to be read: "Industrial Trucks in the Service of the Pennsylvania Railroad Company," T. V. Buckwalter, Pennsylvania Railroad; "The Electric Taxicab," I. S. Scrimger, general manager Detroit Taxicab & Transfer Company; "The Hartford Electric Company's Experience with the Battery Maintenance and Battery Exchange System," Samuel Ferguson, vice-president Hartford (Conn.) Electric Light Company; "The Function of the Electric Garage," R. Macrae, Commonwealth Edison Company, Chicago; "Comparative Development of General Power and Commercial Electric-Vehicle Loads and Function of Power Salesmen as Electric-Vehicle Solicitors," H. H. Holding and S. G. Thompson, Public Service Corporation of New Jersey; "Problems We Are Facing and How They May Be Met," George H. Kelly, secretary Baker, Rauch & Lang Company and president Electric Automobile Manufacturers' Association; "The Field for the Small Electric Delivery Vehicle," Charles A. Ward, secretary and treasurer Ward Motor Vehicle Company; "Electric Vehicles in Municipal Service," Arthur J. Slade, consulting engineer for New York City; "The Comparative Operation of Electric and Gasoline Machines in the Same Service," by D. N. Nims and W. J. Miller in collaboration with Mr. Pratt.

Washington Convention of Illuminating Engineering Society.—At the ninth annual convention of the Illuminating Engineering Society, to be held at the New Willard Hotel, Washington, D. C., Sept. 20 to 23, there will be presented. in addition to the reports of the committees on nomenclature and standards, on lighting legislation, on research, and on progress, papers on the following subjects: "Lighting of Ships," by H. A. Hornor; "Lighting of a Passenger Steamer," by H. F. Spaulding; "Life-Testing of Incandescent Lamps at the Bureau of Standards," by Dr. G. W. Middlekauff, J. F. Skogland and B. Mulligan; "Use of Portable Photometers," by W. F. Little; "Compensating Illuminating Test Plates," by Dr. C. H. Sharp; "Illumination Efficiencies as Determined in an Experimental Room," by Ward Harrison and Earl A. Anderson; "Semi-indirect Office Lighting of the Chicago Edison Building," by W. A. Durgin and J. B. Jackson; "Street Lighting with Gas Lamps," by George S. Barrows; "Arc Lamps for Street Illumination," by H. E. Clifford; "New Types of Incandescent Lamps and Their Relation to Street-Lighting Problems," by W. H. Rollinson; "Application of Principles of Scientific Street Lighting," by F. A. Vaughn; "How Can a Combination Gas and Electric Company Render the Best Service to the Customer?" by A. B. Spaulding and H. N. Potter; "The Selection of a Standard Unit for Lighting," by W. H. Moulton; "Small Incandescent Lamps and Special Illumination Problems," by R. P. Burrows; "Illumination and One Year's Accidents," by R. E. Simpson; "The Application of Crova's Method of Colored-Light Photometry to Modern Incandescent Illuminants," by Dr. H. E. Ives and R. F. Kingsbury; "The Relative Photographic and Visual Efficiencies of Light Sources," by L. A. Jones, M. B. Hodgsen and Kenneth Russ; "A Method for Studying the Behavior of the Eye Under Different Conditions of Illumination," by Prof. F. K. Richtmyer and H. L. Howes; "The Flame Pilot Ignition of Incandescent Gas Lamps," by C. W. Jordan; "Practical Illumination as Exemplified by Some Recent Installations of Incandescent Gas Lamps," by R. F. Pierce; "Mercury-Vapor

Lamps for Industrial Lighting," by W. A. D. Evans; "The Retinal Sensibilities Related to Illuminating Engineering," by Dr. P. G. Nutting; "Vision and Brightness of Surroundings," by P. W. Cobb; "A Flux Method of Obtaining Average Illumination," author to be named later; "Artificial Illumination of Architectural Interiors," by David Crownfield; "Artificial Lighting of Typical Offices in the State, War and Navy Department Building," by W. E. Chapman; "Lighting in Down-Town Office Buildings," by A. O. Dicker and J. J. Kirk; "Present Practice in the Lighting of Armories and Gymnasiums with Tungsten-Filament Lamps," by A. L. Powell and A. B. Oday; "Ultra-Violet Light and the Eye," by W. E. Burge; "Production and Application of Ultra-Violet Rays," by Max von Recklinghausen; "The Parabolic Mirror," by F. A. Benford; "Some Experiments on the Eye with Inverted Reflectors of Different Densities," by Prof. C. E. Ferrée and G. Rand; "The Effect of Variation of Atmospheric Pressure on the Candle-Power of Flames," by Dr. E. B. Rosa, E. C. Crittenden and A. H. Taylor; "Yellow Light," by M. Luckiesh, and "Artificial Illuminants for Use in Practical Photography," by C. E. K. Mees.

Public Service Commission News

Indiana Commission

The contest that has centered about the Danville Light, Heat & Power Company has again been brought before the Public Service Commission for settlement, citizens having petitioned the commission for authority to erect a competing plant. They charge inadequacy of service and discourtesy of officials. The Merchants' Heat & Light Company of Indianapolis has sought to connect transmission lines with the Danville plant as a remedy for the situation, but the county commissioners of Hendricks County, in which Danville is situated, refused permission. The question of rates also is involved, and it is understood an attempt is to be made to agree on rates that will satisfy the citizens. The commission also is asked in the petition to abrogate rules of the company which are objectionable to the citizens.

Missouri Commission

Another valuation of the property of the Springfield (Mo.) Gas & Electric Company is being made during September by Engineers Baldwin and Harrup of the force of the Missouri Public Service Commission, preparatory to further hearings of the injunction suit against the commission in the federal court. The valuation upon which the commission based its report and ordered the reductions of rates against which the company is contending was made by engineers hired for the purpose by the commission.

Massachusetts Commission

The Public Service Commission has received a notification from the Bay State Street Railway, Boston, that it proposes to establish a 6-cent fare unit on its system, beginning Nov. 1. The company operates probably the largest system in the world in track mileage, about 960 miles of line being in service. Its operations extend from Nashua, N. H., to Newport, R. I., and its steps toward an increased fare have been viewed as constituting one of the most courageous and frank actions of a public service corporation in Massachusetts in many years.

Idaho Commission

The Public Utilities Commission recently issued an important order in granting the petition of the Great Shoshone & Twin Falls Water Power Company, approving a contract entered into by the receiver of that corporation, William T. Wallace, with the Electric Investment Company, by which the lines of the two companies will be connected at or near Mountain Home for the delivery of electrical energy to the Electric Investment Company for the use of irrigation pumping plants in the southwestern part of the State of Idaho. Under the terms of the contract the Great Shoshone Company will deliver 44,000-volt energy in an amount up to a demand of 1200 kw. at a rate of 0.4 cent per kilowatt-hour, with an optional understanding that additional power over and above the 1200 kw., if needed, will be delivered at a rate of $1 per horsepower per demand per month, plus 0.2 cent per kilowatt-hour.

Corporate and Financial

American Water Works & Electric Company, New York City.—This company has issued its first annual report covering the year ended June 30, 1915, on the properties controlled by it. The gross income of $994,475 does not include the revenues from the West Penn Traction Company, one of the principal subsidiaries, as the returns have not yet been received from that property. The surplus for the year, $478,638, was much in excess of the requirements for dividends on the first preferred stock, but the setting aside of $500,000 for the fourteen months ended June 30, 1915, toward the reserve fund of $1,250,000 for the purpose of assisting the financing of the construction of subsidiary water companies prevented the payment of dividends on this stock. The report is as follows:

Gross income (excluding West Penn Traction Company)		$994,475
Expenses		48,353
Net earnings		$946,121
Interest on bonds, trust notes, etc.		467,483
Net income		$478,638
Net income April 27, 1914, to June 30, 1914		89,969
Total credits		$568,607
Set aside for reserve fund	$500,000	
Savings in interest through exchange of notes	19,455	
Total debits		519,455
Credit balance remaining June 30, 1915		$49,152

Cities Service Company, New York City.—The Cities Service Company and its subsidiaries for the year ended July 31, 1915, broke all previous records in earnings, the combined gross earnings of the subsidiary companies being $20,256,539. Earnings applicable to the securities of the holding company are shown below:

	Twelve Months Ended July 31, 1915	*Twelve Months Ended July 31, 1914	Month of July, 1915	Month of July, 1914
Gross earnings	$4,003,721.67	$3,543,736.90	$297,625.58	$271,637.15
Expenses	153,578.41	97,269.26	14,370.29	8,962.29
Net earnings	$3,850,143.26	$3,446,467.64	$283,255.29	$262,674.86
Interest on notes	489,999.99	320,991.07	40,833.33	40,833.34
Net to stock	$3,360,143.27	$3,125,476.57	$242,421.96	$221,841.52
Dividends preferred stock paid and accrued	†1,593,996.00	1,422,124.60	†130,833.00	†136,833.00
Net to common	$1,766,147.27	$1,703,351.97	$111,588.96	$85,008.52
Dividends to common stock		702,686.01		
Net to surplus	$1,766,147.27	$1,000,665.96	$111,588.96	$85,008.52

Surplus reserve	$358,198.48
Surplus	4,163,667.12
Total surplus and reserve	$4,521,865.60

*The twelve months statement ending July 31, 1914, covers the period three months prior and nine months subsequent to the acquisition of the Utilities Improvement Company and the Consolidated Cities Light, Power & Traction Company. †Accrued.

An upward tendency in the earnings of electric and gas companies is shown. For July the earnings applicable to the Cities Service Company were $297,626, which was an increase of $25,989 over July, 1914. The net earnings were $283,255, a gain of $20,580, and the balance applicable to dividends for the month was $242,422, a gain of $20,580. After providing for preferred dividends there was a surplus for the common stock of $111,589, as compared with $85,009 for July, 1914. The improvement of industrial conditions in central and northwestern Ohio has helped materially the earnings of the Central Ohio Gas & Electric Company. The Bristol Gas & Electric Company has obtained a five-year 200-hp. contract, while the Danbury & Bethel Gas & Electric Company has extended its lines into new territory and the Empire District Electric Company is making a good showing as a result of the activity in the zinc-mining and lead-mining districts of Missouri and Kansas. The Meridian Light & Railway Company's report shows increasing business and improved conditions are reported throughout that region. The increased demand for energy from the Ohio electric light and power properties is causing estimates to be made for additional generating installations.

Commonwealth Power, Railway & Light Company.—Although the report of this company for July shows a greater surplus than for July, 1914, the surplus for the twelve months ended July 31, 1915, is less than for the same period last year. The report is as follows:

	1915	1914	Increase
Month of July:			
Gross earnings†	$1,182,520	$1,143,335	$39,185
Operating expenses (including taxes)	654,686	625,936	28,750
Net earnings	$527,834	$517,399	$10,435
Interest, etc.	365,166	358,812	6,354
Surplus	$162,668	$158,587	$4,081
Twelve months ended July 31:			
Gross earnings	$14,072,518	$13,970,316	$102,202
Operating expenses (including taxes)	7,565,138	7,699,022	133,884*
Net earnings	$6,507,380	$6,271,294	$236,086
Interest, etc.	4,327,623	4,055,815	271,808
Surplus	$2,179,757	$2,215,479	$35,722*
Preferred stock dividend	960,000	960,000	.....
Balance	$1,219,757	$1,255,479	$35,722*

*Decrease. †In the above statement all earnings from business done between the companies, such as the sale of energy by one company to another, have been eliminated.

Dallas (Tex.) Electric Company.—The operating income of this company for July, 1915, although considerably less than was reported a year ago, shows a marked improvement over the preceding month. The loss in gross income, which amounted to $144,101, was $35,030, while a decrease of only $15,850 is shown in the net earnings of $50,099. The surplus, after interest charges, etc., were deducted, was $16,702, as compared with $32,299 for the same month last year.

Eastern Power & Light Corporation, New York City.—This company has declared the regular quarterly dividend of 1.5 per cent on its preferred stock, payable Sept. 15 on stock of record Sept. 2.

Galveston-Houston (Tex.) Electric Company.—A decided decrease in the gross operating revenue for July of this company is noticeable in comparison with the same month a year ago. The gross operating revenue amounted to $174,093, which was $52,571 less than was earned in 1914, and the net income decreased from $114,229 to $66,457. The surplus after charges were deducted was $30,541 against $75,788 in the preceding year. There was a loss of $321,854 in gross income for the year ended July 31, the total earnings amounting to $21,132,941, while the net earnings after expenses were deducted were $896,508, a decrease of $192,117.

Mexican Northern Power Company, Santa Rosalia, Chihuahua, Mexico.—The directors state it to be manifest that the company will not be able to meet the interest coupons due Jan. 1, 1916, on the $10,000,000 thirty-year 5 per cent first mortgage bonds, and default will again take place on that date. A committee has been formed to receive deposits of these bonds, and it is hoped that all holders will make such deposits by Oct. 1. These deposits are being asked as a preliminary to arranging a plan of reorganization for the company, the troubles of which came about through the internal difficulties of Mexico. With the proceeds realized from the sale of a part of the $3,000,000 6 per cent thirty-year prior-lien bonds authorized last May and from loans made with the prior-lien bonds as security, the company has been able to make considerable progress on the completion of the company's dam and transmission lines to Parral. The plant, which is designed to furnish 40,000 hp., is situated on the Conches River, 20 miles from Santa Rosalia. The company hopes to furnish energy for industrial plants within a radius of 150 miles by Oct. 1.

North Platte (Neb.) Light & Power Company.—An issue of $150,000 of first mortgage 6 per cent twenty-year gold bonds is being offered at par and interest. The earnings statement for the year ended April 1, 1915, follows:

Gross earnings	$43,314
Operating expenses, maintenance, taxes, etc.	22,951
Net earnings	$20,363
Interest on $150,000 bonds	9,000
Surplus	$11,363

Northwestern Ohio Light Company, Cleveland, Ohio.—The Ohio Public Utilities Commission has authorized the company to issue $400,000 of common stock and $400,000 of 5 per cent first mortgage or first and refunding mortgage forty-year bonds at not less than par. The company, which was recently authorized to operate several properties in Ohio, has been authorized by the commission to take over the Urbana Light Company, the Leipsic electric light plant, the Deshler light and power plant, the Van Wort Public Service Company and the Delphos Electric Light & Power Company. These properties are to be paid for with the above issues in the following manner: Delphos Electric Light & Power Company, $400,000 of new common stock to be exchanged for a like amount of Delphos common stock; $60,500 new common stock and $27,500 bonds to retire a like amount of notes; $34,000 new bonds to be exchanged for a like amount of Delphos bonds. Van Wort Public Service Company, $111,000 of the new company's stock to be exchanged for $125,000 of the Van Wort common stock; $48,000 of new stock and $76,000 of new bonds to retire a like amount of Van Wort notes; $73,500 of new bonds to retire a like amount of Van Wort's bonds. Urbana Light Company, $85,000 new stock to be exchanged for a like amount of Urbana stock; $55,000 new stock and $18,500 of new bonds to retire a like amount of the Urbana notes; $85,000 of new bonds to retire a like amount of Urbana bonds. The proceeds of $30,000 of new bonds are to pay for the Deshler Light & Power Company. The proceeds of $56,000 of bonds are to pay for the Leipsic Electric Light plant.

Puget Sound Traction, Light & Power Company.—This company has reported as follows for the month of June and for the twelve months ended June 30. Comparisons with the similar reports for the previous year show losses in gross earnings, net earnings and surplus after charges in both cases:

	1915	1914	Decrease
Month of June:			
Gross earnings	$592,737	$668,255	$75,518
Net earnings	210,380	254,746	44,366
Surplus after charges	29,037	78,087	49,050
Twelve months ended June 30:			
Gross earnings	$7,908,397	$8,701,960	$793,563
Net earnings	3,082,579	3,642,788	560,209
Surplus after charges	930,807	1,546,175	615,368

River Raisin Hydraulic Electric Company, Monroe, Mich.—Under the authority of the Michigan Railroad Commission the company has executed a trust mortgage to secure the issue of $30,000 in bonds for extending and improving the company's plant, 9 miles west of Monroe.

Southern Sierras Power Company, Denver, Col.—The company has filed with the Railroad Commission an application for a supplemental order approving the disposition of the proceeds of the sale of $798,000 par value of first and refunding bonds, and for authority to sell $150,000 additional bonds. Of the money obtained from the sale of $798,000 of these bonds, $10,003.60 is to be applied to reimburse the company's treasury for retiring notes, and the remainder is to be used to reduce indebtedness to the Nevada-California Power Company. If the bonds are sold at 90, this remainder will amount to $708,196.40, the total being $718,200. The $150,000 of bonds are desired to be sold to net not less than 90 per cent, the proceeds to apply on indebtedness to the Nevada-California Power Company and the Sierras Construction Company.

Utah Securities Corporation, Salt Lake City, Utah.—During the month of July the subsidiary properties showed favorable increases both in gross and net earnings. The gross earnings increased 7 per cent and the net earnings increased 18 per cent. These gains are largely the result of strenuous new-business efforts in Salt Lake City and the renewed activity of the copper mines. The gains in July are more remarkable when compared with a 1 per cent gain in gross earnings for the seven months ended July 31 and a gain of 5 per cent in net earnings for the same period.

Stone & Webster Properties.—The companies under the Stone & Webster organization have reported on business during July and for the twelve months ended July 31. With the exception of the Puget Sound Traction, Light & Power Company, the Houghton Valley electric properties, the Savannah Electric Company, the Northern Texas Electric Company, the Keokuk Electric Company, the Cape Breton Electric Company, the Jacksonville Traction Com-

pany, the Galveston-Houston Company, the Sierra Pacific Electric Company, the Key West Electric Company and the Dallas Electric Company, all properties showed increases in their surpluses after charges for the twelve months ended July 31, 1915, as compared with the twelve months ended July 31, 1914. The reports of several of the larger companies follow:

MISSISSIPPI RIVER POWER COMPANY

Month of July:	1915	1914	Increase
Gross earnings	$139,828	$133,479	$6,349
Net earnings	111,110	105,114	5,996
Surplus after charges	3,033	15,314	12,281*
Twelve months ended July 31:			
Gross earnings	$1,618,160	.....	.....
Net earnings	1,272,751	.....	.....
Surplus after charges	70,740	.....	.....

*Decrease.

KEOKUK ELECTRIC COMPANY

Month of July:	1915	1914	Decrease
Gross earnings	$18,687	$21,643	$2,956
Net earnings	6,575	7,796	1,221
Surplus after charges	4,734	5,982	1,248
Twelve months ended July 31:			
Gross earnings	$238,263	$249,901	$11,638
Net earnings	78,421	94,667	16,246
Surplus after charges	55,947	64,576	8,629

DALLAS ELECTRIC COMPANY

Month of July:	1915	1914	Decrease
Gross earnings	$144,101	$179,131	$35,030
Net earnings	50,099	65,949	15,850
Surplus after charges	16,702	32,299	15,597
Twelve months ended July 31:			
Gross earnings	$1,933,274	$2,283,051	$349,777
Net earnings	806,979	929,027	122,048
Surplus after charges	406,161	594,762	188,601

EL PASO ELECTRIC COMPANY

Month of July:	1915	1914	Increase
Gross earnings	$77,426	$83,641	$6,215*
Net earnings	33,419	34,968	1,549*
Surplus after charges	29,217	30,773	1,556*
Twelve months ended July 31:			
Gross earnings	$991,199	$981,560	$9,639
Net earnings	455,045	436,090	18,955
Surplus after charges	404,710	386,444	18,266

*Decrease.

SAVANNAH ELECTRIC COMPANY

Month of July:	1915	1914	Decrease
Gross earnings	$67,285	$73,627	$6,342
Net earnings	22,979	25,332	2,353
Surplus after charges	296	2,401	2,697
Twelve months ended July 31:			
Gross earnings	$806,732	$850,681	$43,949
Net earnings	284,164	284,224	60
Surplus after charges	6,476	10,266	3,790

TAMPA ELECTRIC COMPANY

Month of July:	1915	1914	Increase
Gross earnings	$78,979	$83,683	$4,704*
Net earnings	37,524	39,044	1,520*
Surplus after charges	33,159	34,588	1,429*
Twelve months ended July 31:			
Gross earnings	$982,096	$945,837	$36,259
Net earnings	477,913	426,297	51,616
Surplus after charges	425,169	370,669	54,500

*Decrease.

Manufacturing and Industrial

The Kuhlman Electric Company has moved from Elkhart, Ind., to Bay City, Mich., where it has built a new factory double the size of its former plant.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed H. E. Merrithew district manager of its St. Louis office, which is at 1434 Syndicate Trust Building.

C. O. Mailloux, consulting engineer, 20 Nassau Street, New York, is in the market for between 2,000,000 and 3,000,000 lamp bases which are to be supplied to a foreign concern.

The Westinghouse Lamp Company, 1261 Broadway, New York, has moved its Chicago office from 39 South La Salle Street to the Conway Building, Clark and Washington Streets.

H. M. Wicker, 41 Park Row, New York, has taken over the manufacture and sale of an electric linotype pot formerly made by the Westinghouse Electric & Manufacturing Company.

C. H. Guckel, formerly general manager of the Springfield (Mo.) Gas & Electric Company, is planning to open an establishment in Springfield, with an agency for electrical devices and supplies.

New Western Electric Quarters in Portland, Ore.—The Western Electric Company, 463 West Street, New York, has recently moved its establishment at Portland, Ore., to a new two-story brick-and-concrete building at East Ash and Union Streets.

Young & Vann, Birmingham, Ala., dealers in electrical supplies, have recently taken over the business of the Turner Electric Supply Company, which was formerly the Southern Wesco Supply Company.

The Stuart-Howland Company, Congress and Purchase Streets, Boston, Mass., dealer in electrical merchandise, has appointed M. B. Chase, formerly New York manager for the Sangamo Electric Company, as representative in the New England territory.

Wallace & Smith.—F. J. Wallace, who has conducted an electrical store at Lodi, Cal., for more than two years, has formed a partnership with B. L. Smith of New Orleans, and the business will hereafter be conducted under the firm name of Wallace & Smith.

The Burke Electric Company, Erie, Pa., manufacturer of motors, generators and welding equipment, motor generator sets, transformers, etc., has appointed W. T. Osborn as direct sales representative in charge of its Kansas City branch sales office at 1505 Commerce Building.

The Remy Electric Company.—The engineering, sales and advertising departments of the Remy Electric Company of Anderson, Ind., manufacturer of magnetos, have been moved to Detroit, Mich., in the company's new building on East Grand Boulevard, opposite the plant of the Packard Motor Car Company.

The Clinton Electric Company, Worcester, Mass., has just opened an electrical supply store in the Associates' Block, Worcester. William O'Toole, for the past twelve years engaged in the electrical business, is superintendent of the company, and Thomas Moriarity, formerly with the Bruce-Heustis Electrical Company of Fitchburg, Mass., is manager.

Performance of Baker's Oven.—D. H. Heywood, American Ford, Utah, reports the following performance and cost of operation for July, 1915, of a No. 220 baker's oven manufactured by the Hughes Electric Heating Company of Chicago, Ill.: 10,000 loaves of bread, 260 dozen cinnamon rolls, 312 layer cakes, 600 dozen small cakes and cookies and 130 jelly rolls, with a total energy cost of $12.

The Smith-Ward Brake Company.—The Sauvage-Ward Brake Company, 833 Whitehall Building, New York, manufacturer of electric-railway appliances, has recently changed its name to the Smith-Ward Brake Company. The W. R. Kerschner Company is Eastern sales agent, at 50 Church Street, New York. The Southeastern sales agent is J. B. N. Cardoza, Inc., Citizens' Bank Building, Norfolk, Va.

Demand for Tungsten Results in New Transmission Line.—As a result of huge orders from Europe for tungsten, a six-mile transmission line has been built by the Southern Sierra Power Company from Randsburg, Cal., to the tungsten mines at Atola, Cal., for the purpose of supplying energy for enabling a great increase of production at these mines. So urgent were the orders for tungsten that the contract called for the completion of the line in two weeks' time.

New Courses in Industrial Instruction.—The Wentworth Institute, Huntington Avenue and Ruggles Street, Boston, Mass., has this year added two new courses, a description of which appears in its current catalog just issued. One is a one-year day trade course in forging, hardening and tempering, which is intended to give training to young men who wish a thorough knowledge of both hand and machine forging in wrought iron and steel. The second new course is intended for those who wish to enter some one of the manufacturing industries. The institute also offers next year for the first time the second year of its course in architectural construction. This course is for training building superintendents, specification men and constructionists for architects and building contractors.

Former Importer of Ball Bearings Turned Manufacturer.—Among the ball-bearing importers seriously affected by the European war was the Norma Company of America, 1790 Broadway, New York, organized in 1911 to handle in America the products of the Norma Compagnie of Cannstatt, Germany. The "Norma" line includes single and double annular-ball bearing, roller bearings, single-ball and double-ball thrust bearings, combined annular-ball and ball-thrust units and combined roller and ball-thrust bearings. The Norma ball bearings have met with favor, it is

claimed, for magnetos and for lighting generators and starting motors for automobiles. In 1912 the Norma Company of America established a small plant in this country to add to the supply of ball bearings imported. Up to the outbreak of the war the plant had gradually been enlarged. Fortunately, at that time the company was well stocked with bearings of all sizes and had several large shipments in transit. Additions are still being made which the manufacturer claims will continue so long as the demand for Norma bearings promises to exceed the supply.

Medals for Western Electric Company.—The Grand Prix was recently awarded to the Western Electric Company, 463 West Street, New York, by the International Jury of Award of the Panama Pacific International Exposition for its exhibit as a whole. Gold medals were awarded as follows: one for telephone switchboards and equipment; another for telephone train-dispatching and control apparatus; a third for insulated wire and cable. Two bronze medals were given to the company for its mine-rescue equipment and mine telephones. Silver medals were awarded to the following manufacturers, with the distribution of whose products the Western Electric Company is closely identified; these companies had their products displayed in the Western Electric Company's exhibit: The American Electrical Heater Company, for electric irons; the Gray Pay Station Company, for telephone pay stations; Edwards & Company, for annunciators; the Conlon Washing Machine Company, for Western Electric-Conlon washing machines.

NEW YORK METAL MARKET PRICES

	Aug. 31 Selling Prices Bid	Asked	Sept. 7 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot*	68 10 0		66 5 0	
Prime Lake	17.50	to 17.87½†	17.37½	to 17.62½†
Electrolytic	17.37½	to 18.62½†	17.25	to 17.50†
Casting	16.50	to 17.00†	16.37½	to 16.62½†
Copper wire base	19.25†		19.25†	
Lead	4.90		4.90	
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Spelter, spot	16.50	to 16.75†	15.00	to 15.25
Tin, straits	33.50		33.37½	
Aluminum, 98 to 99 per cent	35.00	to 37.00	41.00	to 46.00

*OLD METALS

Heavy copper and wire	15.75	15.75
Brass, heavy	10.75	10.75
Brass, light	9.50	9.50
Lead, heavy	4.60	4.60
Zinc, scrap	14.00	14.00

*COPPER EXPORTS

Total tons to Sept. 7 395

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Lamoni Electric Company of Lamoni, Ia., has been incorporated with a capital stock of $40,000. The officers are: Albert Carmichael, president; Joseph Roberts, vice-president; H. C. Burgess, secretary, and F. D. Blair, treasurer.

The Marine Electric Service Company of Marine, Ill., has been incorporated with a capital stock of $2,500 by H. F. Neale, Gertrude Neale and R. S. Seese. The company proposes to supply electricity for lamps, heaters and motors; also accessories and equipment.

The Wright Brothers Light & Power Company of Ramsey, Ill., has been incorporated with a capital stock of $2,500 by Alva B. Wright, Raymond C. Wright and J. J. Wright. The company intends to generate and distribute electricity for lamps, heaters and motors.

The North Glidden Electric Company of Glidden, Ia., has been incorporated with a capital stock of $5,000 for the purpose of supplying electricity in the township of Glidden. The officers are: J. G. Merritt, president; J. J. Sylvester, vice-president; C. C. Briggs, secretary, and F. P. Briggs, treasurer.

New Industrial Companies

The Eagle Electric Company of Detroit, Mich., has been incorporated with a capital stock of $100,000 by Herman A. Schmidt, C. C. Shith, Arthur Greasley, Frederick S. Baker and Henry C. Judson.

The Cayer Signal Company of Chicago, Ill., has been chartered with a capital stock of $250,000 to manufacture and deal in electrical and mechanical attachments and devices. The incorporators are J. L. Cayer, Frank McDonald and John W. Eskholme.

Trade Publications

Testing of Insulators.—The R. Thomas & Sons Company, East Liverpool, Ohio, is sending out a folder on the testing of its insulators.

Pole-Line Devices.—W. N. Matthews & Brother, St. Louis, Mo., have issued a small folder which illustrates and lists a number of their pole-line fixtures.

Outlet Boxes and Covers.—The Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa., has prepared Leaflet No. 151 on its outlet boxes and covers.

Water-Tube Boilers.—The A. D. Granger Company, 90 West Street, New York, has just published Bulletin No. 2 on its Oswego internally fired water-tube boilers.

Electricians' Tools.—Catalog No. 16 published by Mathias Klein & Sons, Chicago, Ill., illustrates and describes a large number of tools for electricians, linemen and mechanics.

Water-Tube Boilers.—The Heine Safety Boiler Company, St. Louis, Mo., has issued an illustrated bulletin entitled "Boiler Logic," which contains information on its water-tube boilers.

Rust-Resisting Iron.—The American Rolling Mill Company, Middletown, Ohio, has issued catalogs entitled "Defeating Rust: The Story of Armco Iron," and "Armco Rust-Resisting Products." Both catalogs are illustrated.

Silent Chains for Textile Mills.—Publication No. 13, entitled "A Chain of Evidence," has been issued by the Morse Chain Company, Ithaca, N. Y., and contains information on its silent chains for use in textile mills.

Electric Protective Equipment and Material.—Catalog No. 1 published by the Electric Fuseguard Company, 391 Mulberry Street, Newark, N. J., contains information on various types of inclosed fuses and other electric protective equipment.

Electrically Heated Linotype Pot.—The Mergenthaler Linotype Company, New York City, has recently published an illustrated booklet in which its experience with Cutler-Hammer electrically heated linotype pots is discussed and operating cost data are given.

Motors and Generators.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued descriptive leaflets as follows: No. 3796-A on its small type CD direct-current generators, No. 3820 on its type CW alternating-current heavy-duty slip-ring motors, and No. 3841 on its small type CD direct-current motors.

Electrical Devices.—The Western Electric Company, 463 West Street, New York, has recently issued folders on its interphone outfits, interwoven "Flextube" conduit, Pyrene fire extinguishers, silk shades for electric portable lamps, Matthews "Scrulix" anchors, Diamond expansion bolts, Standard porcelain spark plugs, Hubbell shade holders, magneto telephones, Blue Bell batteries, magneto-telephone switchboards, small electric motors and small generating plants.

Inclosed Switches, Fuses and Motor Starters.—The Detroit Fuse & Manufacturing Company, Detroit, Mich., has published an illustrated bulletin, No. 37, on its "Square D" steel-inclosed switches, Bulletin No. 38 on its "Arkless" fuses, Bulletin No. 39 on its "Square D" steel-inclosed service switches and distributing cabinets, Bulletin No. 40 on its "Square D" ironclad fused switches, Bulletin No. 41 on its "Square D" induction-motor starters, and Bulletin No. 42 on its "Square D" fused plug receptacle and attachment plug.

Construction News

New England

BAR HARBOR, ME.—The town has ratified the legislative act empowering it to establish a municipal lighting plant.

UNITY, ME.—It is reported that plans are being considered whereby the town will have an electric street-lighting system by the first of next year.

SWANTON, VT.—The Swanton municipal electric plant is replacing its old wood flume with a dam and a retaining wall of concrete, making a larger forebay and adding a short section to penstock to connect with the waterwheel. Next summer the company plans to build a new dam and to add another hydroelectric unit. C. J. Parker is manager.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 8, for the installation of a complete elevator plant in the United States appraisers' stores at Boston, Mass., in accordance with drawings and specifications, copies of which may be obtained at the above office.

PEPPERELL, MASS.—The Town Council has accepted the proposal of the Shirley El. Co. of Shirley to supply electrical service here. The proposition provides for the purchase of the municipal distributing system by the Shirley company, the erection of a new substation in Pepperell and extensions of lines for commercial lighting and power services.

NAUGATUCK, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 13, for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Naugatuck. Drawings and specifications may be obtained at the above office or from the custodian of site at Naugatuck.

WESTPORT, CONN.—Sealed proposals will be received up to 2 p. m., Sept. 22, by the State Highway Commissioner, C. J. Bennett, Hartford, for the construction of a single-leaf deck-lift bridge over the Saugatuck River at Westport, the bids to include the furnishing and installing of the necessary electrical equipment for operating the bridge.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by L. H. Pounds, president of borough of Brooklyn, Borough Hall, Brooklyn, until Sept. 15, for installation of electric wiring and fixtures, etc., in various offices and rooms in basement and first floors of the Borough Hall. Blank forms and further information may be obtained at the office of the Bureau of Buildings and Offices, 50 Court Street, Brooklyn.

EAST ROCHESTER, N. Y.—The Board of Trade has recommended to the Village Board a proposition for installing ornamental lighting on Commercial Street from Madison to Washington Street and on Main Street from Maple Street to Fairport Road.

GOWANDA, N. Y.—The Gowanda Lt. & Pwr. Co. has taken possession of the former Keyes El. Co. and has begun active work in improving the lighting system here. New poles are being erected and a large generator for temporary use is being installed. Plans are now being made for a new power house.

NEW YORK, N. Y.—Bids will be received by R. A. C. Smith, commissioner of docks, Pier A, foot of Battery Place, North River, until Sept. 16, for furnishing cylinder, dynamo and marine-engine oils.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of department of water, gas and electricity, Room 2342, Municipal Building, New York, until Sept. 13, for furnishing electric incandescent lamps. Blank forms for proposals and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, city of New York, Municipal Building, New York, until Sept. 28 for furnishing and installing electrical operating equipment for gang-driven valves and sluicegates at Ashokan, Kensico, Hill View and Silver Lake reservoirs. For details see proposal columns.

NEW YORK, N. Y.—Bids will be received by the State Hospital, Commission, Albany, N. Y., until Sept. 24 for addition to power house, including construction, heating and equipment, plumbing and drainage, electric work and coal and ash conveying equipment, at Manhattan State Hospital, Ward's Island, N. Y. Drawings and specifications may be obtained at the Department of Architecture, Albany, N. Y., upon deposit of $10, and may be consulted at the Manhattan State Hospital and at the New York office of the Department of Architecture, Room 1224, Woolworth Building.

NEW YORK, N. Y.—Bids will be received by the board of trustees, Bellevue and Allied Hospitals, Bellevue Hospital, 415 East Twenty-sixth Street, New York, until Sept. 16, for furnishing and installing the interior telephone system, including main trunk cables, etc., of Bellevue Hospital. Blank forms and further information may be obtained at the office of contract clerk, 400 East Twenty-ninth Street, New York.

SKANEATELES, N. Y.—The Niagara, Lockport & Ontario Pwr. Co., Buffalo, N. Y., has petitioned the Public Service Commission for permission to construct electric lines here.

JENKINTOWN, PA.—The State Public Service Commission has granted the Jenkintown Lt., Ht. & Pwr. Co. a rehearing of application for approval of the contract between that company and the township to supply a municipal electric-lighting system using 25-cp. tungsten gas-filled incandescent lamps.

NORTHAMPTON, PA.—The Borough Council has entered into a contract with the Lehigh Valley Lt. & Pwr. Co. of Allentown for the installation of about forty magnetite-arc lamps and a large number of 40-watt series incandescent lamps for street illumination.

SOUTH BETHLEHEM, PA.—The L. P. Lipshutz Cigar Co. of Philadelphia is contemplating the construction of a large cigar factory in South Bethlehem. The plant, it is understood, will be equipped throughout with electrically driven machinery.

TARENTUM, PA.—The borough has authorized the expenditure of $21,000 for improvements to the municipal electric plant. Engineer S. B. Martin of Pittsburgh will have charge of the work.

CAMDEN, N. J.—A special committee has been appointed by the Board of Education to engage an architect and make arrangements for preliminary work for the construction of a new manual training and high school, to cost about $400,000.

CAPE MAY, N. J.—At an election to be held Sept. 14 the proposal to establish a municipal electric-lighting plant will be submitted to the voters.

MILLVILLE, N. J.—Bids will be received by R. B. Corson, director of public safety, Millville, until Sept. 17 for lighting the streets and public places of the city of Millville for a period of five years, in accordance with plans and specifications prepared by W. E. S. Temple, consulting engineer.

NEWARK, N. J.—The American Synthetic Dyes, Inc., will erect a new power plant on Avenue R, to be used for manufacturing operations.

BALTIMORE, MD.—Mayor Preston is considering the advisability of utilizing Jones' Falls as a source of hydroelectric power. The projected development will cost about $200,000, it is reported, and the plans are in the hands of E. D. Whitman, consulting engineer to the Water Board.

WINCHESTER, MD.—It is reported that the advisability of establishing a municipal electric-light plant is being considered. Dr. Hunter H. McQuire is chairman of the light committee.

BERKELEY SPRINGS, W. VA.—The Northern Virginia Pwr. Co. of Winchester, Va., is planning to increase the water-power development of its hydroelectric plant on the Cacapon River, five miles from Berkeley Springs. The plans provide for the installation of a 1200-hp. water turbine, already purchased.

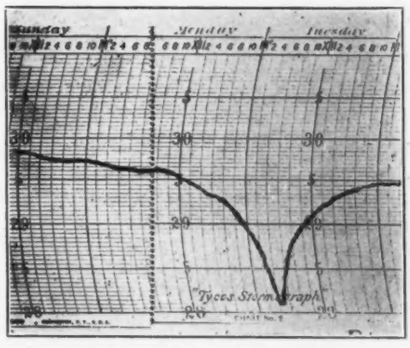
FARMVILLE, VA.—The contract for extensons to the municipal electric light and water systems has been awarded to the J. B. McCrary Co. of Atlanta, Ga.

NORFOLK, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 28 for elevator repairs in the United States court house and post office at Norfolk, Va. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent, State, War and Navy Building, Washing-

How Construction Plans Were Laid to Repair Houston's Storm Damage Before It Happened

Rapid reconstruction work — planned while the great tropical hurricane which swept the Gulf Coast of Texas on Aug. 16 was still at its height, and executed with the help of line crews and supplies that had been summoned from neighboring cities before the telegraph lines went down as the storm approached — resulted in restoring service to the customers of the Houston (Tex.) Lighting & Power Company with a minimum interruption of only five hours. Early on Monday, the day of the hurricane, when the swiftly falling barometer and the threatening Weather Bureau reports gave the first warnings of the blow, Dan Hegarty, general manager of the Houston company, began to use the telegraph wires in an effort to get outside line crews and construction material into Houston in preparation for any damage that might be wrought. Before the telegraph circuits finally ceased working—for during the next forty-eight hours Houston was isolated from all outside communication—men were reached in towns and cities as far away as New Orleans, and during the ensuing two days, while Houston was still cut off from the world, the railroads which were able to resume partial operation were already bringing men and supplies into Houston, reaching there in time to render much assistance in the work of restoring service. The company's power plant, storeroom and office building became camps for the workers during the following busy days and nights of reconstruction. Two hundred extra arc lamps were ordered shipped by express to supplement the Houston company's normal stock of fifty, which went quickly to replace lamps destroyed. Fortunately the Houston properties went through the storm with only slight damage to lines, but the fact that service was restored to the business district with only five hours' interruption was largely due to the sound executive judgment in planning to meet the contingencies of the storm while they were yet impending.



At Houston the Advance Antics of the Barometer Gave the Cue for Summoning Outside Construction Help Before the Telegraph Lines Went Down

Some Effects of the Gulf Coast Storm of Aug. 16. Overhead Lines, Poles and Roofs All Suffered in the High Wind and the Accompanying Deluge of Rain

ton, until Sept. 18, for removing the present hoisting engine used for operating the ash-hoist and substituting therefor an electrically operated hoist.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 21, for furnishing at the Brooklyn Navy Yard the following supplies: Ships' bells, copper burrs, boatswains' calls, electrical supplies, storage-battery testing outfits, etc. Proposal blanks may be obtained at the above office or from the navy pay office, New York, N. Y.

North Central

BURR OAK, MICH.—The electors of Burr Oak Township, St. Clair County, have confirmed the grant of a franchise to the United El. Co. for the purpose of operating in the township. The plan of the company is to connect its stations in Burr Oak, Colon, Mendon, Leonidas and Parkville Townships together so as to be able to furnish electricity at a reduced cost. Franchises have already been secured in other townships.

HOLT, MICH.—The Consumers' Pwr. Co. of Lansing is to extend its lines to this village.

MONROE, MICH.—By authority of the State Railroad Commission, the River Raisin Hydraulic El. Co. has executed a trust mortgage to secure the issue of $30,000 in bonds for extending and improving the company's plant, 9 miles west of Monroe.

MOUNT PLEASANT, MICH.—The City Council is considering the plan of the city owning and operating the plant and equipment of the Consolidated Lt. & Pwr. Co., Mount Pleasant, which is now in the hands of the receivers.

CINCINNATI, OHIO. — Joseph Reichert and others are interested in the construction of a new 50-ton ice plant, to be controlled by independent ice dealers of this city. Plans will be furnished by the York Ice Machine Co. of York, Pa.

DAYTON, OHIO.—The Dayton Pwr. & Lt. Co. has secured franchises and street-lighting contracts in the villages of Spring Valley and Bellbrook, and expects to furnish electrical service in both villages before the end of the year. Thomas F. Kelly is commercial manager.

LOGAN, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 14, for construction, including mechanical equipment and approaches, of the United States post office at Logan. Drawings and specifications may be obtained at the above office or from the custodian of site at Logan.

LONDON, OHIO.—Arrangements are being made to erect new ornamental street lamps on several streets for which funds are available. The system will be extended to other streets as soon as the money is appropriated.

MASSILLON, OHIO.—The City Council is considering the installation of a new ornamental street-lighting system, plans for which have been submitted by E. Whitford Jones, consulting engineer of Cleveland. The plans call for the erection of 1121 lamps and will be installed by the Massillon Gas & El. Co., if approved by the Council.

OSTRANDER, OHIO. — Electricity for street lamps and other purposes will be supplied by the electric plant installed in the garage owned by J. C. Maugans.

SALEM, OHIO.—An ordinance was recently passed granting the Salem El. Lt. & Pwr. Co. the right to construct and maintain an electric light, heat and power plant in Salem. The company agrees to replace motors now in use on the lines of the Columbia County Lt. & Pwr. Co. with motors that will be suitable to 60-cycle energy, which the new company expects to furnish.

UHRICHSVILLE, OHIO.—A committee of the City Council is inspecting municipally owned plants in the State with a view toward considering plans for a local plant.

WOOSTER, OHIO.—The Wooster El. Co. is constructing a line from Wooster to Smithville for the purpose of lighting the streets of that village and the residences, business houses, etc. The line will also extend to Oak Grove church, to furnish electrical service in that vicinity, and to residents along the line. A lighting service will also be installed in the village of Madisonburg. The transmission line will be from 9 to 12 miles in length and will involve the use of about 600 poles, about 250 meters and 40 60-watt tungsten lamps for street-lighting purposes. C. P. Allis of the electric company is the engineer.

ASHLAND, KY.—The Ohio Valley El. Ry. Co. of Huntington, W. Va., plans to build an extension from Ashland to Russell.

CLAY, KY.—The Clay El. Lt. & Pwr. Co. is contemplating the construction of a laundry to be operated in connection with its electric plant.

CYNTHIANA, KY.—The Kentucky Utilities Co., Lexington, Ky., it is reported, has an option to purchase the property of the Cynthiana El. Lt. Co. The utilities company desires a twenty-year franchise similar to that in other cities. The franchise requires that a plant be maintained in the town for continuous or emergency use.

LOUISVILLE, KY.—Plans, it is reported, are being considered by H. P. Selman & Co., Fourth and Walnut Streets, for the installation of a private lighting plant, to be driven by an oil engine.

PRESTONBURG, KY.—Construction of the Consolidation Coal Co.'s long-distance power transmission line has been completed from Jenkins to Prestonburg. This line, intended primarily to supply energy for mining operations, will also supply electricity for lighting a number of towns in the Big Sandy Valley.

PROVIDENCE, KY.—The proposal to issue $20,000 in bonds to establish a municipal electric-light plant will be submitted to the voters at the November election. The Providence El. Lt. Co., now operating without a franchise, has offered its plant to the city.

AUBURN, IND.—City bonds to the amount of $6,000 have been sold to cover the cost of installing a boulevard lighting system.

BOONVILLE, IND.—Within the next twelve months the Boonville El. Lt. & Pwr. Co. expects to install a stationary boiler. K. H. Weyerbacher is manager.

COLUMBIA CITY, IND.—The Columbia City El. Lt. & Waterworks Co. expects to install within the next eight months an engine, generator and switchboard. S. C. Schultz is superintendent.

ALTON, ILL.—The contract for construction of a power house for the Illinois Insane Hospital (under construction) at Alton has been awarded to J. J. Wuellner & Son of Alton, at $64,000.

CARTHAGE, ILL.—Arrangements are being made to transmit electric energy from the Keokuk-Hamilton plant to Carthage to be utilized for power and illumination purposes.

CHICAGO, ILL.—The Chicago & Northwestern Ry. Co. has engaged the John S. Metcalf Co., grain elevator engineer, 619 Temple, Chicago, to act as designing and consulting engineer for its new grain elevator plant at South Chicago. The plant will be equipped with electrically driven machinery, deriving power from a complete independent power plant of 4700 hp. Water-tube boilers and turbo-generators will be used. An independent office building for convenience of operators, a welfare building for employees, a shop building and 1200 ft. of wharf are also included in the project. Plans will be submitted to contractors at an early date.

HOOPESTON, ILL.—The Hoopeston Gas & El. Co. is installing a main steam plant to replace its former gas-engine and producer plant. H. D. Hayden is manager.

INCEVILLE, ILL.—E. P. Ince has closed negotiations for the purchase of an electric-power plant to furnish electricity for lamps and motors in Inceville, to be operated in connection with the New York Motion Picture Corp. The equipment purchased amounts to about 250 hp.

LORAINE, ILL.—Bert Van Blair, recently granted an electric-light franchise, has begun work on construction of an electric plant in Loraine.

NASHVILLE, ILL.—The Nashville El. Lt. Co. is building 18 miles of transmission lines for the purpose of connecting Addieville and Hoyleton, Ill., to its present plant.

BARABOO, WIS.—Work has begun on the construction of the new power house for the municipal electric plant, which will supply electricity for street-lighting and other purposes and also for operating the city water-works pumping station.

CLINTON, WIS.—The Clinton El. Lt. Co., a Wisconsin corporation, has been formed and a proposition has been made to the town to light the streets with electricity.

DANE, WIS.—The village of Dane has contracted with the Wisconsin River Pwr. Co. for electrical energy for electric lighting and power service. The power company will erect a substation at Dane, stepping down from high-tension, three-phase, to three-phase, four-wire, the secondaries of the transformers being connected in star, the delta voltage being 3980, with 2300 volts from one wire to ground. The system at Dane will consist of a 2300-volt, single-phase primary distribution system with a 110/220 volt secondary distribution system for commercial customers and a series, gas-filled tungsten street-lighting equipment. Vaughn, Meyer & Sweet, Milwaukee, Wis., are the engineers.

MADISON, WIS.—The Industrial Foundry Co., St. Johns, Mich., has been awarded the contract for installing the proposed ornamental lighting system and furnishing the cable. The amount of the bid was $9,875.

NEW BUTLER, WIS.—The State Railroad Commission has granted the Butler El. Lt. Co. permission to issue $10,000 in capital stock, the proceeds to be used for completion of plant now under construction.

TWIN FALLS, WIS.—The Peninsular Pwr. Co., owner of the hydroelectric plant here, is formulating plans for the immediate extension of its transmission lines from Alpha to the Crystal Falls, Mich., district. The company has contracted to furnish electrical energy to operate the machinery of the Bristol Mining Co.

WASHBURN, WIS.—Negotiations are under way between the Commercial Club and F. W. Downs, manager of the Washburn El. Lt. & Pwr. Co., for the installation of an ornamental street-lighting system in Washburn.

MAGNOLIA, MINN.—A contract, it is reported, has been awarded to W. T. Dean of Magnolia to construct an electric-light plant here.

REDWOOD FALLS, MINN.—The Wherland El. Co. of Redwood Falls is reported to be contemplating enlarging its plant.

ST. CLOUD, MINN.—The Pub. Ser. Co. of St. Cloud, it is reported, has completed negotiations for a bond issue of $4,000,000, the proceeds to be used for the construction of a new power house and for extensions of its transmission lines to every town within a radius of 60 miles. A. G. Whitney is president.

SLAYTON, MINN.—The Slayton Pwr. Co. is planning to enlarge its power plant. New equipment, consisting of a 100-hp. engine, generator and switchboard, will be installed. The company will install either oil, gas-producer or steam engine; not yet decided. It will also erect 6 miles of transmission line. F. H. Eddy is manager.

STRANDQUIST, MINN.—G. P. Janson is reported interested in a project to install an electric-lighting system in Strandquist.

BAGLEY, IOWA.—Within the next six months the electric-light commissioners expect to purchase one 35-hp. power engine, one 20-kw. three-wire generator and a switchboard arranged for paralleling with a present equipment of the same capacity. E. G. Nichols is manager.

CHARITON, IOWA.—The Union Service Co. is now constructing 37 miles of transmission lines east and west from the city. It is also installing a 600-kw., three-phase, 60-cycle, 2300-volt steam-driven generating unit. Willis Todd is vice-president and manager.

CLINTON, IOWA.—The City Council has passed resolutions providing for the installation of type "C" 250-watt series lighting unit lamps with Holophane refractor and porcelain reflector within sixty days to take the place of the present lamps.

DUBUQUE, IOWA.—The Union El. Co. has secured a franchise from the board of highway commissioners of Dunleith for extending its transmission lines from Dubuque to St. Clara's College at Sinsinawa. Energy will not only be transmitted to the college, but will be utilized by farmers along the right-of-way.

JOLLEY, IOWA.—The Council is considering the question of establishing a municipal electric-light plant in Jolley.

LONE TREE, IOWA.—The Zimmerman Steel Co. has sold its electric plant and distributing system to the Fairfield Incubator Co., Fairfield, Neb. The new concern will make a number of changes, necessitating the installation of motor-driven machines used in the manufacture of incubators.

OGDEN, IOWA.—Bids will be received by D. A. Good, president of the Independent School District of Ogden, Ogden, until Sept. 17, for construction of school building, including general construction work, heating and plumbing, electrical work and equipment. Plans and specifications may be procured at the office of Alban & Lockhart, architects, St. Paul, Minn.

WATERLOO, IOWA.—The Citizens' Gas & El. Co., Charles City, is erecting transmission lines through certain portions of Black Hawk County.

AURORA, MO.—The Lawrence County Lt. & Cold Storage Co. of Aurora has closed a contract with the Ozark Wtr. & Pwr. Co.

for energy for a period of 15 years, to be supplied from the hydroelectric plant at Powersite.

BEVIER, MO.—The Council is contemplating calling an election to submit the proposal to issue from $10,000 to $15,000 in bonds for extensions to street-lighting system and other street improvements.

BRANSON, MO.—The Ozark Pwr. & Wtr. Co. of Branson is perfecting plans for extending its service to many cities of west-central Missouri and possibly into Kansas.

DREXEL, MO.—Work has begun on the construction of the proposed municipal electric-light plant in Drexel, to cost about $9,000. The Bicknell Co., International Building, Kansas City, has charge of the engineering work.

MACON, MO.—Bids will be received by C. H. Payson, Mayor, until Sept. 14, for improvements to water-works system, including the construction of a mechanical filter plant having a capacity of 654,000 gal. per day, equipped with four motor-driven centrifugal pumps, capacity from 400 to 500 gal. per minute, barometric condenser, etc. E. E. Harper, 914 Grand Temple Avenue, Kansas City, Mo., is consulting engineer.

WEST PLAINS, MO.—Plans are being considered for improvements to the municipal electric-light plant.

DRAYTON, N. D.—Work will soon be started on building and equipping an electric-light plant of the direct-current, three-wire, 220-110-volt type. H. M. Waldren, J. R. Strong, E. R. Buchanan, W. S. Dryden and W. J. Lean are the directors of the company.

ST. HILAIRE, N. D.—It is reported that in a few weeks electric service from the lines of the Red River Pwr. Co., Grand Forks, will be available for lighting and power purposes.

TOWNER, N. D.—A tentative ordinance granting a franchise to C. S. Rygh, Alexandria, Minn., was recently placed before the City Council. Mr. Rygh, formerly at Edgeley, has asked for a twenty-year franchise under the terms of which the city has the privilege of purchasing the plant at the end of the franchise period.

HAVELOCK, NEB.—R. E. Taylor, electrical engineer, recently submitted to the City Council specifications for the erection of cluster lamps in the business district, and he was directed to procure bids from electrical contractors for laying the cable conduit system. The type of pole selected will carry hanging globes 6 in. by 12 in. and one upright globe 8 in. by 14 in. The poles will be 12 ft. in height.

MASON CITY, NEB.—Bids will be received by John T. Wood, village clerk, until Sept. 17, for one 25-hp. oil engine, one 15-kw., 125 to 250-volt, direct-current generator, switchboard, storage battery, etc., and construction of brick power station. Cost of the work is estimated at about $6,500.

OMAHA, NEB.—The Field Club district-lighting system will be taken over by the city if the ordinance introduced by Commissioner Butler is favorably acted upon.

ARGONIA, KAN.—The City Council has adopted an ordinance providing for the installation of a municipal electric-light plant. Nathan L. Jones, Smith Building, Wellington, it is reported, has been engaged as engineer.

HOYT, KAN.—The installation of a municipal electric-light plant is reported to be under consideration.

LARNED, KAN.—The United El. Co., Wichita, Kan., has secured a $15,000 contract for the equipment of the new electric-light plant. This contract includes pole-line hardware, wire, transformers, switchboards, etc.

LAWRENCE, KAN.—The City Commissioners and the business men along Massachusetts Avenue, it is reported, are considering the advisability of installing a "white way" five blocks long on Massachusetts Avenue.

LONGTON, KAN.—The proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant, it is reported, will soon be submitted to the voters.

MARION, KAN.—Plans have been completed for the construction of a new power house for the municipal electric-light plant, to cost about $5,000. The plant, it is reported, was recently destroyed by fire.

MILAN, KAN.—The City Council, it is reported, has engaged Nathan L. Jones, engineer, Smith Building, Wellington, to prepare plans for the proposed municipal electric-light plant.

Southern States

BURLINGTON, N. C.—The Alamance, Durham & Orange Ry. & El. Co. plans to build extensions from Burlington to Elon College and Gibsonville and to Altamahaw and Ossipee. Julius Harden, Burlington, is reported to be interested.

BURNSVILLE, N. C.—Plans are being considered by Charles W. Harper, consulting engineer of Burnsville, and associates, for the construction of a hydroelectric power plant, to be equipped with a 125-hp. water turbine, a 75-kva. generator, etc.; also the erection of four miles of transmission line. It is proposed to organize a company with a capital stock of $16,000 to carry out the project.

COVINGTON, GA.—The municipal electric light and water plant expects to erect within a short time a water-filter coagulation basin to cost about $2,000. F. T. Harrison is superintendent.

GRAYMONT, GA.—The cities of Graymont and Summit are contemplating calling an election to submit to the voters the proposal to build an electric-light plant, to cost about $5,000, to supply both cities with electrical service.

SUMMIT, GA.—The cities of Summit and Graymont are considering a proposal to build an electric-light plant, at a cost of about $5,000, to supply both municipalities with electricity.

OCALA, FLA.—Bids will be received by the city of Ocala until Sept. 20 for the construction of a municipal electric-light plant and water-works system. The cost is estimated at about $150,000. Twombly & Henney, 55 Liberty Street, New York, N. Y., are consulting engineers.

PERRY, FLA.—The Allis-Chalmers Co. will construct an electrically operated planing mill addition to the plant of the Burton-Swartz Lumber Co. here, using individual drive and installing a 300-kw. Westinghouse turbine generator. The company is now building two lumber mills with electric drive, one for the Finkbine Lumber Co., Dlo, Miss., and the other for the Caddo River Lumber Co., Rosboro, Ark.

TAMPA BAY, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 20, for construction, including mechanical equipment, of attendants' quarters, disinfecting shed, oil house, wharf, etc., for the quarantine station at Tampa Bay. Drawings and specifications may be obtained from the above office or from the custodian at Tampa Bay.

NASHVILLE, TENN.—The City Council has decided to install new stoking equipment in the municipal electric-light plant, as recommended by M. A. Rooney, city smoke inspector.

SHELBYVILLE, TENN.—The Valley Cotton Mills, recently organized with a capital stock of $50,000 by W. J. McGill and others, is planning to build a cotton mill to be equipped with electrically operated machinery. Electricity will be obtained from the transmission system of the Chattanooga & Tennessee River Pwr. Co. of Chattanooga, which will increase its output by the construction of a hydroelectric power plant on Duck River.

WESSON, MISS.—The City Council has engaged M. L. Culley, engineer, of Jackson, to prepare plans for the installation of a municipal electric-light plant and water-works system.

COTTER, ARK.—E. D. Griswold & Co. have sold their generating plant to the Gertrude Mining Co., Rush, Ark.

OKLAHOMA CITY, OKLA.—Preparations, it is reported, are being made by the Southwestern Pwr., Lt. & Ry. Co. to finance and construct three hydroelectric power plants at a cost of about $1,000,000. The plans provide for an initial development of about 23,500 hp. for transmission by electricity for lamps and motors, also for the operation of the proposed interurban electric railway from Oklahoma City to Denison, Tex. The company also contemplates the construction of several hydroelectric plants in south and southeast Oklahoma, increasing the developments to 75,000 hp. W. T. Croslen, Securities Building, Oklahoma City, is president.

DALLAS, TEX.—Bonds to the amount of $10,000 have been voted for the installation of a lighting system in Highland Park District.

DENISON, TEX.—The Texas Pwr. & Lt. Co., Dallas, has purchased a site on the Red River, near Denison, on which to build and have in operation by Dec. 31, 1916, a power plant to cost about $750,000. It is proposed to furnish electric energy from this plant to operate the cars of the Texas Trac. Co.'s line and also for power and lighting purposes throughout North Texas and Southern Oklahoma by means of high-tension transmission lines.

JEFFERSON, TEX.—Electric energy for daylight use is now being supplied in this town from the Marshall plant of the Marshall El. Co., of which C. H. Maendall is manager.

MARBLE FALLS, TEX.—E. M. Turner of Dallas has been appointed receiver of the Colorado Pwr. Co., which is constructing a large dam across the Colorado River here as a means of providing power for a large hydroelectric plant that it is planned to build. It is reported that Mr. Turner will carry out the original construction purposes of the company as rapidly as possible.

Pacific States

COULEE CITY, WASH.—The Town Council has granted a franchise to Oscar Ellefson to construct and operate an electric light and power plant in Coulee City. Work, it is understood, will begin at once on construction of the plant.

GOLDENDALE, WASH.—The Pacific Pwr. & Lt. Co. of Portland, Ore., has petitioned the Commissioners of Klickitat County for a franchise to erect and operate electric transmission lines throughout the county.

MEDICAL LAKE, WASH.—Bids will be received by the State Board of Control, Capitol Building, Olympia, until Sept. 21 for construction of buildings on the site of the State Institution for Feeble-Minded at Medical Lake, to be let in four contracts as follows: For general contract, plumbing and drainage, heating and ventilating, and electric wiring and fixtures. Drawings and specifications may be obtained at the office of Julius Zittel, architect, Jamieson Building, Spokane, Wash. E. S. Emigh is secretary of board.

MORTON, WASH.—The Lewis County Lt. & Tele. Co., with head offices here, is rearranging all its main lines and is removing its telephone lines from the main streets to the alleys inside the city limits. The company is making preparation for stringing aditional power transmission lines and will make needed extensions and improvements, the major portion of this work to be done early next spring.

OLYMPIA, WASH.—Bids will be received by the State Board of Control, Capitol Building, Olympia, until Sept. 21 for construction of buildings on the site of the Northern State Hospital at Norlum, near Sedro-Woolley, to be let in four contracts as follows: General contract, plumbing and ventilating, heating and ventilating, and electric wiring and fixtures. Drawings and specifications may be obtained at the office of Heath & Gove, architects, National Realty Building, Tacoma. E. S. Emigh is secretary of board.

SEATTLE, WASH.—The Commissioners of King County have granted the Puget Sound Trac., Lt. & Pwr. Co. a franchise to supply electricity over the entire southern portion of the county, the area involved being bound on the north by the southern limits of the city of Seattle, extending eastward to the summit of the Cascade Mountains, following the Kittitas County line on the east, the Pierce County line on the south and Puget Sound on the west.

TACOMA, WASH.—Plans have been prepared for the installation of ornamental lamps, erected on iron standards, on E Street, from Tacoma Avenue to Jefferson Avenue. Bids, it is understood, will be received at an early date. B. W. Collins is manager of the municipal electric plant.

NEHALEM, ORE.—The West Coast El. Co. of Tillamook, Ore., has been awarded the contract for installing a street-lighting system here.

BERKELEY, CAL.—The City Council has directed the Department of Public Works to prepare specifications for a street-lighting plan involving the use of one-lamp electroliers as proposed by Commissioner F. T. Robson.

SAUSALITO, CAL.—The Board of Town Trustees has awarded the contract for the installation of electroliers, covering a distance of about one mile, to the Pacific Fire Extinguisher Co. of San Francisco, at $2,717. The plans call for the erection of 65 one-lamp compressed-steel standard electroliers. Leonard L. Hohl is town engineer.

KENDRICK, IDAHO.—The City Council is reported to have granted a franchise to A. V. Dunkle of Plummer for the construction of an electric-light plant in Kendrick, to cost about $10,000.

PHOENIX, ARIZ.—James B. Girand, city engineer, has announced that the Department of the Interior has granted permission to conduct preliminary operations in connection with the establishment of six dams, reservoir and power sites in the Grand Canyon of Arizona, by which it is

planned to develop over 400,000 hp. of hydroelectric energy. It is reported that, in addition to furnishing electrical energy for railroads and mines, the plan includes a scheme for the electrical fixation of atmospheric nitrogen for the manufacture of fertilizer.

CULBERTSON, MONT.—The City Council has been petitioned for the installation of an ornamental lighting system on the business and residence streets.

GLASGOW, MONT.—The City Council is considering improvements to the municipal electric-light plant, to cost about $18,000. H. Palmer is city clerk.

GREAT FALLS, MONT.—The Montana Pwr. Co. is installing a 6.6-amp. series incandescent street-lighting system involving the use of 289 cast-iron posts and 374 100-cp. lamps. A quantity of 600-volt park cable will be used. A transformer will be used for each 48 lamps. The approximate cost of the installation is $10,000, and the contract has been let to the Electric Supply Shop, Great Falls. M. L. Morris of the power company is in charge.

DENVER, COL.—Within the next few months the Continental Mines, Pwr. & Reduction Co. expects to erect several miles of transmission lines and probably to purchase a quantity of electrical appliances and supplies. Henry I. Seemann is president and manager.

LOVELAND, COL.—The installation of an electric-light plant to supply electricity for lighting two buildings in the business district is reported under consideration by Frank Bartholf.

Canada

CHATHAM, ONT.—Plans are being considered for the installation of two electrically driven centrifugal pumps, of 2,000,000-gal. and 3,000,000-gal. capacity, in the municipal water-works pumping station, at an estimated cost of about $4,000,000.

PETROLEA, ONT.—The town of Petrolea has decided to erect a new distributing system for the distribution of electricity supplied by the Ontario Hydro-Electric Power Commission.

PORCUPINE, ONT.—The Northern Canada Pwr. Co., it is reported, has decided to increase the output of its plant in Porcupine, at a cost of about $1,000,000.

THISTLETOWN, ONT.—A movement is on foot in Thistletown to link up this village with the Ontario Hydro-Electric system. It is proposed to secure the service through the substation at Weston.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Sept. 22, for steel shapes and plates, billet steel, soft-steel bars, tire steel, cold-rolled steel, manganese steel, electric cable, electric-lighting units, boiler punches and dies, etc. Blanks and general information relating to this circular (No. 965) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 3, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,151,586. Apparatus for Melting and Spraying Fusible Substances; F. Herkenrath, Zurich, Switzerland. App. filed March 21, 1914. Uses blowpipe flame.

1,151,605. Heater; J. C. Morgan, Chicago, Ill. App. filed June 17, 1912. Sterilizer for dentists and surgeons.

1,151,670. Wire Strainer; D. Donald, Sydney, New South Wales, Australia. App. filed June 3, 1914. Lever and wire-gripping construction.

1,151,683. Telephone System; H. L. Harris, Elyria, Ohio. App. filed Dec. 12, 1913. Control of cut-off apparatus.

1,151,706. Electric Welding Machine; F. Muller, Hartford, Conn. App. filed Dec. 23, 1911. For butt-welding around pieces of work.

1,151,707. Electric Relay or Repeater; T. A. Nathans, New York, N. Y. App. filed July 25, 1907. Eliminates parts having mechanical inertia.

1,151,720. Electric Railway Signal System; J. J. Ruddick, Newton, Mass. App. filed Jan. 3, 1911. Employs insulated rail sections.

1,151,726. Horn-Gap Lightning Arrester; E. O. Schweitzer and N. J. Conrad, Chicago, Ill. App. filed Oct. 12, 1914. No resistance path at formation of discharge, with increasing difficulty for continuance of discharge.

1,151,739. Circuit-Breaker; C. A. Tucker, Edgwood Park, Pa. App. filed. Dec. 29, 1909. Readily operable for large current.

1,151,756. Carriage Return Mechanism for Typewriting Machines; O. Bennett, Placerville, Cal. App. filed Aug. 21, 1914. Solenoid returns carriage and annular rack rotates platen.

1,151,761. Electrical Measuring Instrument; J. Le C. Davis, Pittsburgh, Pa. App. filed June 14, 1912. For ascertaining energy lost in circuit.

1,151,783. Protective Apparatus for Alternating-Current Distribution Systems; G. Harlow and K. M. Faye-Hansen, Stratford, England. App. filed April 18, 1911. Primary of series transformer connected at each end of the feeder section.

1,151,796. Relay; A. E. Keith, Chicago, Ill. App. filed Nov. 15, 1911. Individual springs readily accessible for adjustment.

1,151,799. Casing for Lamp Sockets, Pendent Switches and the Like; C. J. Klain, Milwaukee, Wis. App. filed March 17, 1913. Special lock securing the cap to the shell body.

1,151,800. Lamp Socket; C. J. Klein, Milwaukee, Wis. App. filed Jan. 28, 1914. Push-button structure mounted in molded insulating casing.

1,151,804. Electric Motor; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. For alternating-current or direct-current electric-railway work.

1,151,824. Electric Condenser; G. Routhe, Sayville, N. Y. App. filed March 24, 1915. Designed for wireless work.

1,151,841. Electric Arc Lamp; W. C. H. Wefel, Denver, Col. App. filed May 13, 1912. Novel regulating mechanism.

1,151,867. Wireless-Controlled Steering Mechanism; K. Dougan, Minneapolis, Minn. App. filed April 21, 1910. For dirigible torpedoes and the like.

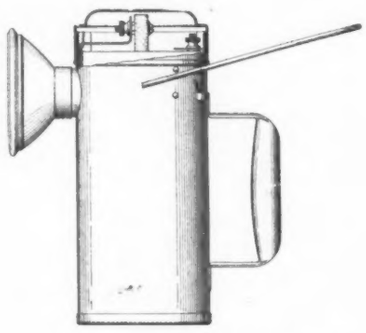
1,151,946. Ignition System; C. Hartmann, Lancaster, N. Y. App. filed June 11, 1913. New arrangement of interrupter connections.

1,151,981. Trolley-Operated Contact; C. W. Ward, East St. Louis, Ill. App. filed Feb. 4, 1911. Vertically movable hanger lifted by trolley to operate switch.

1,151,990. Reversing Mechanism for Cylinder Washing Machines; F. Balzer, Chicago, Ill. App. filed Nov. 8, 1913. Reverses current flow through the operating motor.

1,151,991. Reversing Mechanism for Electrically Driven Washing Machines; F. Balzer, Chicago, Ill. App. filed Nov. 8, 1913. Single mechanism reverses plurality of machines.

1,152,005. Coupling Connector for Submarine Cables; Le Roy Clark, Englewood, N. J. App. filed Sept. 19, 1913. For mechanically and electrically connecting cable sections.



1,152,155—Electric Flashlamp or Lantern

1,152,018. Telegraph Circuit; J. J. Ghegan, Newark, N. J. App. filed May 7, 1914. Uses inductorium at terminal station.

1,152,027. Temperature Regulator; F. T. Kitchen, New York, N. Y. App. filed April 1, 1915. Reduces sparking in thermostatic controlling devices.

1,152,059. Type-Printing Electric-Telegraph System; W. S. Steljus, London, England. App. filed Sept. 10, 1912. Electric printing machine; uses polarized relay.

1,152,062. Automobile Lock Switch; C. G. Terfler, Chicago, Ill. App. filed March 31, 1913. Key-operated ignition switch.

1,152,082. Electric Flashlamp or Lantern; A. L. Edwards, Wheeling, W. Va. App. filed May 13, 1915. Entire electrical connections secured to top of battery cell.

1,152,085. Sparker for Explosive Engines; W. H. Ferguson, Columbus, Ohio. App. filed March 12, 1915. Makes the leaving of the contacts closed impracticable.

1,152,088. Relay; L. A. Hawkins, Schenectady, N. Y. App. filed Nov. 18, 1911. Responsive to current of only one frequency.

1,152,092. Method of Advertising and Apparatus Therefor; F. T. Hopkins, St. Louis, Mo. App. filed Feb. 14, 1914. For displaying routes and runs of trains or boats.

1,152,094. Railway-Car Signal; J. E. Johnson, Anderson, Ind. App. filed June 7, 1913. Car signal system.

1,152,096. Braking Apparatus for Electrically Propelled Vehicles; P. N. Jones, Pittsburgh, Pa. App. filed May 12, 1913. For running propelling motors as braking generators; operated by a single control.

1,152,139. Station Indicator; W. Beck, Rochester, N. Y. App. filed May 14, 1914. Electrically controlled indicating belt.

1,152,147. Electric Fuse; C. W. Davis, Edgeworth, Pa. App. filed April 22, 1913. Free from tensile strain and separated by the explosive force of fusing.

1,152,148. Electric Fuse; C. W. Davis, Edgeworth, Pa. App. filed April 22, 1913. Has means for relieving the tensile strain.

1,152,149. Electric Fuse; C. W. Davis, Edgeworth, Pa. App. filed July 22, 1913. Readily removable oil fuse.

1,152,155. Electric Flashlamp or Lantern; A. L. Edwards, Wheeling, W. Va. App. filed May 13, 1915. Casing for commercial dry cell carrying lamp structure.

1,152,170. Attachment Plug; G. W. Goodridge, Bridgeport, Conn. App. filed May 11, 1910. Has a snap switch incorporated therewith.

1,152,211. Secondary Rack; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed May 4, 1914. For supporting heavy wires at some distance from supporting pole.

1,152,219. Automobile Headlight; C. Reinker, Lakewood, Ohio. App. filed Aug. 31, 1914. Has dimmed and colored lamps.

1,152,246. Battery Cell; W. L. Walker, Groton, Conn. App. filed March 17, 1915. For submarine and boat use.

1,152,247. Battery Jar; W. L. Walker, New London, Conn. App. filed May 8, 1915. Air circulation keeps cells cool.

1,152,269. Trolley Retriever; E. Benson, Hartford, Conn. App. filed Aug. 15, 1914. Simplified and compact construction.

1,152,272. Electric Spark-Gap; H. Boas, Berlin, Germany. App. filed Oct. 22, 1912. Quenched spark-gap with tungsten electrodes.

1,152,336. Telephone Switch; F. L. Myers, Dewitt, Iowa. App. filed Jan. 29, 1915. Operated by receiver hook to prevent eavesdropping.

1,152,362. Electric Protective System; E. G. Waters, Forest Row, England. App. filed April 27, 1915. For cutting out both ends of faulty cable sections.

1,152,376. Motor-Control System; J. H. Albrecht, Pittsburgh, Pa. App. filed July 29, 1913. Dynamic breaking.

1,152,385. System of Supervision for the Apparatus of a Telephone or Other System; A. E. Keith Chicago, Ill. App. filed May 6, 1907. For enabling location of thermostatic switches which have been operated by abnormal currents.